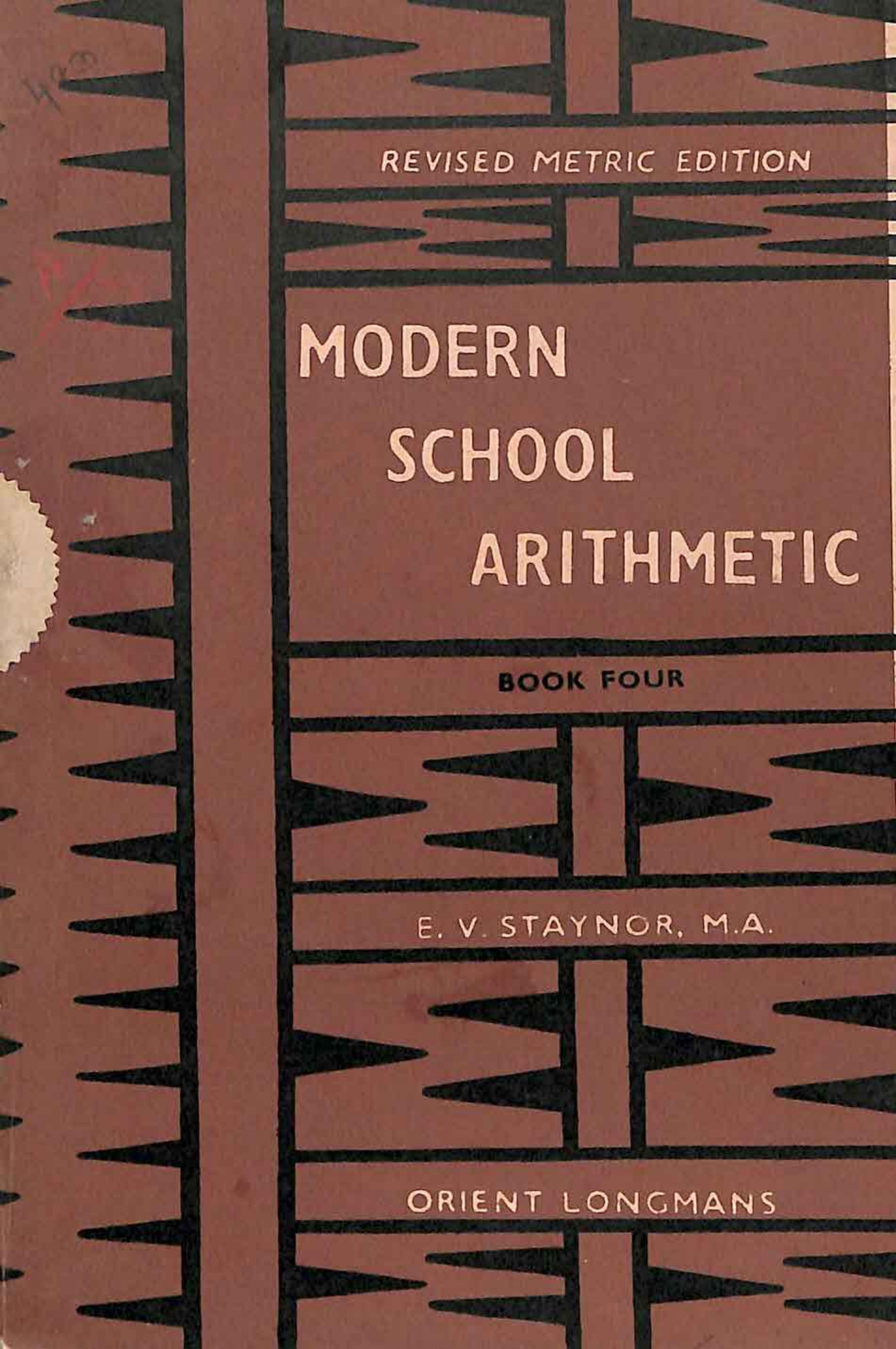

REVISED METRIC EDITION

# MODERN SCHOOL ARITHMETIC

## BOOK FOUR

E. V. STAYNOR, M.A.

ORIENT LONGMANS

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# MODERN
# SCHOOL ARITHMETIC

## REVISED DECIMAL MONEY AND METRIC WEIGHTS AND MEASURES

A

STATE INSTITUTE OF EDUCATION

## BOOK IV

BY

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48, GROSVENOR STREET, LONDON W. I.
*And at* CAPE TOWN, CROYDON (AUSTRALIA), HONG KONG,
KUALA LUMPUR AND TORONTO

*First published 1939*
*Revised Edition, 1957*
*Reprinted 1958, 1959*
*Revised New Edition, 1962*
*Reprinted 1963 (twice)*

31. 1. 2008
13004

*Price Rs.* [illegible]*35* 1·45 P

© *Orient Longmans Limited, 1962*

PRINTED IN INDIA
BY A. K. ROY AT ART UNION PRINTING WORKS PRIVATE LIMITED.
80/15 ARABINDA SARANI, CALCUTTA-6

# MEASURES AND WEIGHTS

## METRIC

### LENGTH

10 millimetres (mm) = 1 centimetre (cm)
10 centimetres (cm) = 1 decimetre (dm)
10 decimetres (dm) = 1 metre (m)
10 metres (m) = 1 dekametre (Dm)
10 dekametres (Dm) = 1 hectometre (Hm)
10 hectometres (Hm) = 1 Kilometre (Km)

### AREA

100 sq mm = 1 sq cm.
1000 sq cm = 1 sq dm.
1000 sq dm = 1 sq m.

### VOLUME

1000 cu. mm. = 1 cu. cm. (c.c.)
1000 cu. cm. = 1 cu. dm.
1000 cu dm = 1 cu metre.

### CAPACITY

10 centilitres = 1 decilitre
10 decilitres = 1 litre
1 litre=1 cu. dm. = 1000 c.c.

### WEIGHT

10 milligrams (mg) = 1 centigram (cg)
10 centigrams = 1 decigram (dg)
10 decigrams = 1 gram (gm)
10 grams = 1 dekagram (Dg)
10 dekagrams = 1 hectogram (Hg)
10 hectograms = 1 Kilogram (Kg)
1000 Kilograms = 1 metric tonne

1 c.c. of water weighs 1 gram
1 litre of water weighs 1 kilogram

# WEIGHTS AND MEASURES

## BRITISH

### WEIGHT

16 ounces (oz) = 1 pound (lb)
28 lb = 1 quarter (qr)
4 qr = 1 hundred weight (cwt)
20 cwt = 1 ton
14 lb = 1 stone
112 lb = 1 cwt
2240 lb = 1 ton
1 gallon of water weighs 10 pounds.

### LENGTH

12 inches = 1 foot (ft)
3 feet = 1 yard (yd)
220 yards = 1 furlong
8 furlong = 1 mile
1760 yards = 1 mile

### AREA

144 sq. inches = 1 sq foot
9 sq feet = 1 sq yd
4840 sq yards = 1 acre
640 acres = 1 sq mile.

### VOLUME

1728 cu. inches = 1 cu. foot
27 cu. feet = 1 cu. yard

### CAPACITY

2 pints (pt) = 1 quart (qt)
4 quarts = 1 gallon (gall)

### MONEY

4 farthings = 1 penny (d)
12 pence = 1 shilling (sh)
20 shillings = 1 pound (£)
21 shillings = 1 guinea
2 shillings = 1 florin
5 shillings = 1 crown

## PRIME FACTORS

Since $36=4\times9$, 4 and 9 are factors of 36, and 36 is called the multiple of 4 and also multiple of 9.

### ORAL.

Complete the following :

$72=3\times2\times$ ....... $143=13\times$ .......
$96=2\times3\times$ ....... $196=7\times$ .......
$132=12\times$ ......... $343=7\times$ .......
$192=4\times$ ......... $729=9\times3\times$ ......

Find the multiples of 5 which are less than 54.
Find the multiples of 7 which are less than 69.
Find the multiples of 11 which are less than 200.

## TESTS OF DIVISIBILITY

A number is divisible by 2 if its last digit is even.

A number is divisible by 3 if the sum of its digits is divisible by 3.

A number is divisible by 4 if the number formed by the last two digits is divisible by 4.

A number is divisible by 5 if the last digit is either 5 or 0.

A number is divisible by 6 if the number is divisible by 2 and 3.

A number is divisible by 8 if the number formed by the last three digits is divisible by 8.

A number is divisible by 9 if the sum of its digits is divisible by 9.

A number is divisible by 10 if the last digit is 0.

A number is divisible by 11 if the sum of the digits in the odd places and the sum of the digits in the even places are equal or differ by a multiple of 11.

## EXERCISES I

Which of these numbers are the multiples of the first number?

(1) 3; 75, 87, 96, 98, 325, 234, 789, 747, 1101.
(2) 4; 172, 186, 196, 422, 456, 729, 852, 924, 1024.
(3) 5; 565, 674, 527, 640, 725, 900, 1205, 1314.
(4) 8; 76344, 98128, 475112, 86568, 71234.
(5) 6; 7584, 432, 528, 2766, 8154, 1234.
(6) 9; 351, 882, 774, 2358, 3511, 9774.
(7) 11; 1111, 788, 234, 1243, 5786, 9897.

A prime number is a number which is divisible by itself and by 1 only.

**Example 1.** 13 has no factors except itself and 1, hence 13 is a prime number.

15 is not a prime number because it is divisible by 3 and 5.

**Example 2.** Find the prime factors of 120.

$$\begin{array}{r|l} 2 & 120 \\ \hline 2 & 60 \\ \hline 2 & 30 \\ \hline 3 & 15 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$$2 \times 2 \times 2 \times 3 \times 5 = 120$$

**Index notation.** (Used for shortness)

$2 \times 2$ is written as $2^2$ and read as "2 squared" or the "square of 2".

$2 \times 2 \times 2$ is written as $2^3$ and read as "2 cubed" or the "cube of 2".

$3 \times 3 \times 3 \times 3$ is written as $3^4$ and read as 3 to the power 4.

$2^5$ is the 5th power of 2.

$5^7$ is the 7th power of 5.

## EXERCISES 2

(1) Write all the prime numbers between 1 and 50.

(2) Write all the prime numbers between 50 and 99.

(3) Choose from the following numbers those that are not prime numbers and express them in prime factors, using the index notation :—

35, 37, 49, 57, 61, 77, 93, 97, 126, 168, 315, 429, 525, 594, 612, 693, 1980, 1365, 3432, 3773.

## LAWS OF INDICES

**Example 3.** Express in index form or notation (i) $3^2 \times 3^4$ (ii) $5^4 \times 5^5$

$$3^3 \times 3^4 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$
$$= 3^7$$
$$5^4 \times 5^5 = 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$$
$$= 5^9$$

In the same way, if we write out completely $7^5 \times 7^6$ there will be $(5+6)$ factors and this is written as $7^{11}$.

So $7^5 \times 7^6 = 7^{11}$

so also $2^4 \times 2^8 = 2^{4+8} = 2^{12}$.

We can now make a rule.

When we are to find the product of powers of the *same number* we ADD the indices.

**Example 4.** Express in index notation $3^7 \div 3^3$

$$3^7 \div 3^3 = \frac{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}{3 \times 3 \times 3}$$
$$= 3 \times 3 \times 3 \times 3 = 3^4$$

that is $3^7 \div 3^3 = 3^{7-3} = 3^4$

We can now make a rule.

When we are to find the quotient of powers of the *same number we* SUBTRACT the index of the divisor.

N.B. We are only dealing here with division where the dividend is larger than the divisor.

## EXERCISES 3

Find the value (in index notation) of the following :—

(1) $2^5 \times 2^3$
(2) $2^5 \times 2^7$
(3) $3^7 \times 3^5$
(4) $3^2 \times 3^9$
(5) $5^4 \times 5^8$
(6) $2^5 \div 2^2$
(7) $3^7 \div 3^3$
(8) $3^9 \div 3^7$
(9) $5^{12} \div 5^4$
(10) $5^6 \div 5^2$
(11) $7^9 \times 7$
(12) $2^3 \times 2^5 \times 2^4$
(13) $3^3 \times 3 \times 3^9$
(14) $(3^2 \times 3^8) \div 3^5$
(15) $(7^6 \times 7^3) \div 7^4$
(16) $2^2 \times 3^2 \times 2^4 \times 3^5$
(17) $5^3 \times 7^2 \times 5^4 \times 7^3$
(18) $(2^3 \times 3^4) \div (2^2 \times 3^3)$
(19) $(3^5 \times 5^3) \div (5^2 \times 3^2)$
(20) $(2^2 \times 3^2 \times 5^3) \div (2 \times 3 \times 5^2)$

## HIGHEST COMMON FACTOR

A number which is a factor of two or more numbers is called a *common factor.*

**Example.** $6 = 2 \times 3$
$9 = 3 \times 3$

$\therefore$ 3 is a common factor of 6 and 9.

The greatest number which is a common factor of two or more numbers is called the *highest common factor* or for short their H.C.F.

The H.C.F. is best found by writing each number as the product of powers of *prime* factors.

**Example.**

Find the H.C.F. of 48, 72, 180.

$$48 = 4 \times 12 = 2^2 \times 2 \times 2 \times 3 \quad = 2^4 \times 3$$
$$72 = 8 \times 9 = 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$$
$$180 = 9 \times 20 = 3^2 \times 4 \times 5 \quad = 2^2 \times 3^2 \times 5$$

The *highest* power of 2 which is a factor of each number is $2^2$; the *highest* power of 3 which is a factor of each number is 3. There is no other *common factor.*

$\therefore$ The H.C.F. is $2^2 \times 3 = 12$.

## EXERCISES 4

Find the H.C.F. of :—

(1) $2^2 \times 3^2 \times 5$; $2^3 \times 3^3 \times 7$
(2) $3^3 \times 5^2 \times 7$; $2^2 \times 3^3 \times 5 \times 11$
(3) $2^3 \times 3^2 \times 5^3 \times 7$; $2^4 \times 3^3 \times 5^2 \times 7$;$2 \times 3^2 \times 5 \times 7^2$
(4) $2^2 \times 3 \times 5^2 \times 13$; $2^3 \times 3^2 \times 13$; $2^2 \times 3^3 \times 11$
(5) $2^2 \times 7$; $3^2 \times 5$; $2^3 \times 7^2$; $3 \times 5 \times 11$
(6) 12, 15, 21 (7) 12, 18, 24 (8) 15, 20, 25
(9) 20, 30, 40 (10) 40, 60, 80 (11) 18, 27, 45
(12) 36, 60, 72 (13) 26, 65, 78 (14) 72, 108, 144
(15) 55, 66, 77 (16) 76, 114, 190 (17) 45, 72, 480
(18) 136, 256, 442 (19) 196, 350, 728 (20) 350, 728, 924

## LEAST COMMON MULTIPLE

A number which is a multiple of two or more numbers is called the *common multiple* of these numbers.

36 is a common multiple of 9 and 12.

The least or smallest number which is a common multiple of two or more numbers is the *least common multiple of* these numbers or for short their L.C.M.

The common multiples of 9 and 12 are 36, 72, 144, 288.

36 is the smallest common multiple.

So 36 is the L.C.M. of 9 and 12.

## EXERCISES 5

(1) Write down 4 multiples of 6, and 5 multiples of 8. What is the L.C.M. of 6 and 8?
(2) Write down 5 multiples of 8, and 3 multiples of 12. What is the L.C.M. of 8 and 12?
(3) Write down 4 multiples of 10 and 4 multiples of 15. What is the L.C.M. of 10 and 15?
(4) What is the L.C.M. of :—
    (a) 4, 9 (b) 6, 10 (c) 8, 14 (d) 4, 14, 21,
    (e) 3, 4, 6 (f) 30, 40, 60 (g) 40, 90 (h) 60, 100

Write in index form the L.C.M. of :—

(5) $2^2 \times 3, 2^3 \times 3^2$; (6) $2 \times 3^2, 3^2 \times 5$
(7) $2^3 \times 5; 3^2 \times 7, 2^2 \times 11$

**Example.** Find the L.C.M. of 18, 24, 30

$$\begin{aligned} 18 &= 2 \times 3 \times 3 &&= 2 \times 3^2 \\ 24 &= 2 \times 2 \times 2 \times 3 &&= 2^3 \times 3 \\ 30 &= 2 \times 3 \times 5 &&= 2 \times 3 \times 5 \end{aligned}$$

Every common multiple of these numbers must have 2, 3, 5 as factors. Each factor must be *highest* power that is found in any of the numbers. The highest power of 2 is $2^3$; the highest power of 3 is $3^2$ and the highest power of 5 is $5^1$.

$\therefore$ The L.C.M. is $2^3 \times 3^2 \times 5 = 8 \times 9 \times 5 = 360$.

It is usually better to have the L.C.M. in factors than to multiply out.

## EXERCISES 6

Find the L.C.M. of :—

(1) 12, 18, 24.
(2) 15, 20, 25.
(3) 40, 60, 80.
(4) 56, 63, 84.
(5) 26, 40, 104.
(6) 25, 75, 110.
(7) 12, 36, 72, 120.

In the following leave the L.C.M. in index form :

(8) 16, 28, 35, 63.
(9) 39, 117, 169.
(10) 76, 114, 190.
(11) 21, 33, 63, 121.

(12) 4, 11, 18, 20, 48, 72.

(13) 204, 304, 585.

(14) 220, 306, 855.

(15) 24, 27, 125, 136, 180.

(16) Find the largest number which is a factor of 504 and 792.

(17) Find the smallest number which is a multiple of each of the numbers 16, 36 and 44.

(18) Divide the L.C.M. of 18, 27, 45 by their H.C.F.

(19) Multiply the L.C.M. of 18 and 27 by the H.C.F. of the same two numbers. Find the product of 18 and 27. What can you say of the two results you obtain? Can you make a rule?

(20) The H.C.F. of two numbers is 4 and the L.C.M. is 24. If 8 one of the numbers, find the other.

## FRACTIONS.

$\frac{3}{5}$ is called a vulgar or common fraction.

5 is called the denominator of the fraction, it is the number of parts into which the whole has been divided; 3 is called the numerator of the fraction, it is the number of parts taken.

$$\text{Fraction} = \frac{\text{Numerator}}{\text{Denominator}}$$

## EXERCISES 7

Write down the values of :—

(1) $\frac{1}{2}$ of Re. 1. (2) $\frac{1}{4}$ of Rs. 2. (3) $\frac{1}{5}$ of Rs. 3.
(4) $\frac{1}{10}$ of Rs. 5. (5) $\frac{1}{20}$ of Rs. 6. (6) $\frac{3}{5}$ of 1 metre.
(7) $\frac{2}{5}$ of 2 metres. (8) $\frac{3}{8}$ of 2 metres. (9) $\frac{5}{6}$of 6m 12cm.
(10) $\frac{7}{20}$ of 15 m. (11) $\frac{5}{12}$ of 1 hr. (12) $\frac{3}{4}$ of Rs. 5.
(13) $\frac{3}{7}$ of 1 wk. (14) $\frac{5}{7}$ of 2 wk. (15) $\frac{3}{8}$ of 24 gm.

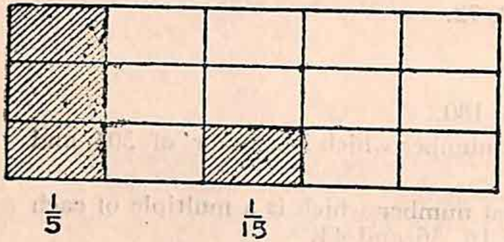

FIG. (*a*)

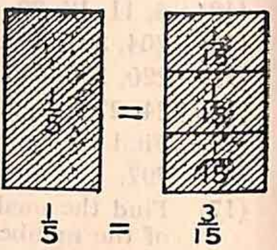

FIG. (*b*)

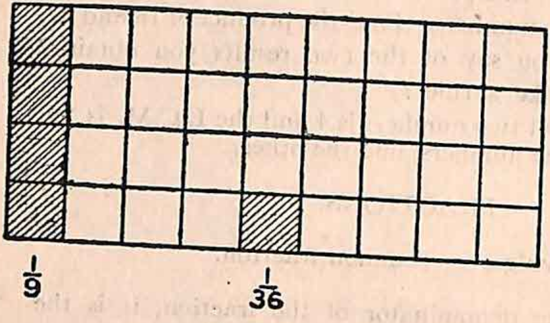

FIG. (*c*)

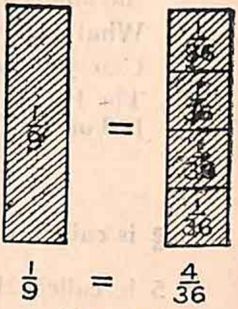

FIG. (*d*)

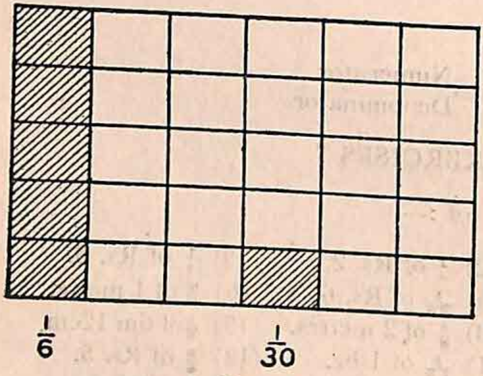

FIG. (*e*)

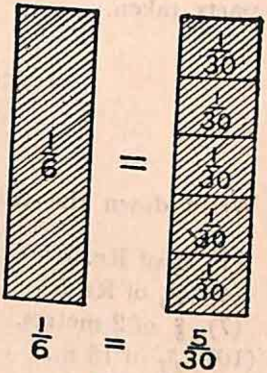

FIG. (*f*)

Diag. (*a*) shows a whole divided up by vertical lines into **5** equal columns. Each column $=\frac{1}{5}$. The left-hand column is shaded in.

Lines are then drawn from left to right dividing each column up into **3** equal parts.

There are **3** of these parts in each of the **5** columns; there are fifteen parts in the whole and so each part is $\frac{1}{15}$.

Diag. (*b*) shows then there is one-fifth in three-fifteenths.

$$\frac{1}{5}=\frac{3}{15}$$

$\frac{3}{15}$ and $\frac{1}{5}$ are **equivalent** fractions.

Diag. (*c*) shows **9** columns each equal to $\frac{1}{9}$.

Each column is divided up into 4 equal parts.

Each part is $\frac{1}{36}$.

Diag. (*d*) shows that $=\frac{1}{9}=\frac{4}{36}$

How do diags. (*e*) and (*f*) show that $\frac{1}{6}=\frac{5}{30}$ ?

## EXERCISES 8

Draw diagrams to show that : (the diagrams may be drawn free-hand)

(1) $\frac{1}{7}=\frac{3}{21}$ (2) $\frac{1}{5}=\frac{4}{20}$ (3) $\frac{1}{3}=\frac{6}{18}$
(4) $\frac{1}{2}=\frac{5}{10}$ (5) $\frac{1}{4}=\frac{3}{12}$ (6) $\frac{1}{8}=\frac{5}{40}$

Fill in the blanks :

(7) $\frac{1}{3}=\frac{\ }{15}$ (8) $\frac{1}{4}=\frac{\ }{24}$ (9) $\frac{1}{5}=\frac{\ }{15}$ (10) $\frac{1}{5}=\frac{\ }{35}$
(11) $\frac{1}{3}=\frac{\ }{18}$ (12) $\frac{1}{5}=\frac{\ }{40}$ (13) $\frac{1}{6}=\frac{\ }{42}$ (14) $\frac{1}{8}=\frac{\ }{32}$
(15) $\frac{1}{3}=\frac{\ }{27}$ (16) $\frac{1}{4}=\frac{\ }{16}$ (17) $\frac{1}{6}=\frac{\ }{48}$ (18) $\frac{1}{8}=\frac{\ }{40}$

See Fig. (*a*) again :

Two columns $=\frac{2}{5}$

There are **6** fifteenths in **2** columns

So $\frac{2}{5}=\frac{6}{15}$

Three columns $=\frac{3}{5}=\frac{9}{15}$

Four columns $=\frac{4}{5}=\frac{12}{15}$

| Fig. (c) | one col. | two cols. | three cols. |
|---|---|---|---|
| | $=\frac{1}{9}$ | $=\frac{2}{9}$ | $=\frac{3}{9}$ continue |
| | $=\frac{4}{36}$ | $=\frac{8}{36}$ | $=\frac{12}{36}$ |

Fig. (*e*)

| one col. | two cols. | three cols. |
|---|---|---|
| $=\frac{1}{6}$ | $=\frac{2}{6}$ | $=\frac{3}{6}$ continue |
| $=\frac{5}{30}$ | $=\frac{10}{30}$ | $=\frac{15}{30}$ |

How can we change the name of a fraction from fifths to twentieths?

How can we change $\frac{3}{5}$ to twentieths?

We divide each fifth into **4** equal parts. Each part will be a twentieth, and 3 fifths will equal **12** twentieths.

$$\frac{3}{5}=\frac{12}{20}$$

Notice that **5** is multiplied by **4**, so also is **3**.

We can change a fraction to an equivalent fraction with larger denominator if we keep to this rule:

**Rule**: *Multiply the numerator by whatever number the denominator has been multiplied. The new fraction will be equivalent to the old fraction.*

## EXERCISES 9

Fill in the blanks.

(1) $\frac{3}{5}=\frac{}{30}$ (2) $\frac{3}{7}=\frac{}{28}$ (3) $\frac{4}{9}=\frac{}{18}$ (4) $\frac{5}{8}=\frac{}{32}$

(5) $\frac{4}{11}=\frac{}{33}$ (6) $\frac{3}{8}=\frac{}{24}$ (7) $\frac{4}{5}=\frac{}{35}$ (8) $\frac{4}{7}=\frac{}{35}$

(9) $\frac{3}{5}=\frac{}{45}$ (10) $\frac{7}{8}=\frac{}{64}$ (11) $\frac{7}{8}=\frac{}{80}$ (12) $\frac{5}{6}=\frac{}{42}$

(13) $\frac{3}{7}=\frac{}{63}$ (14) $\frac{5}{9}=\frac{}{63}$ (15) $\frac{4}{15}=\frac{}{30}$ (16) $\frac{7}{15}=\frac{}{60}$

We may often change a fraction to an equivalent fraction with smaller denominator, if we keep to this rule:

**Rule**: *Divide the numerator by whatever number the denominator has been divided.*

To change $\frac{12}{20}$ to fifths, we divide both **20** and **12** by **4**. So $\frac{12}{20}=\frac{3}{5}$.

## EXERCISES 10

Fill in the blanks:

(1) $\frac{9}{12}=\frac{}{4}$ (2) $\frac{16}{36}=\frac{}{9}$ (3) $\frac{10}{35}=\frac{}{7}$ (4) $\frac{9}{24}=\frac{}{8}$

(5) $\frac{20}{24}=\frac{}{6}$ (6) $\frac{15}{24}=\frac{}{8}$ (7) $\frac{22}{33}=\frac{}{3}$ (8) $\frac{18}{24}=\frac{}{12}$

(9) $\frac{18}{24}=\frac{}{4}$ (10) $\frac{10}{30}=\frac{}{3}$ (11) $\frac{8}{36}=\frac{}{9}$ (12) $\frac{25}{45}=\frac{}{9}$
(13) $\frac{27}{72}=\frac{}{8}$ (14) $\frac{32}{40}=\frac{}{5}$ (15) $\frac{42}{96}=\frac{}{16}$ (16) $\frac{48}{144}=\frac{}{9}$
(17) $\frac{2}{12}=\frac{3}{}$ (18) $\frac{6}{9}=\frac{18}{}$ (19) $\frac{3}{5}=\frac{24}{}$ (20) $\frac{7}{11}=\frac{28}{}$
(21) $\frac{3}{8}=\frac{15}{}$ (22) $\frac{4}{9}=\frac{16}{}$ (23) $\frac{5}{6}=\frac{}{24}$ (24) $\frac{32}{40}=\frac{4}{}$
(25) $\frac{}{7}=\frac{15}{21}$ (26) $\frac{}{4}=\frac{21}{28}$ (27) $\frac{}{7}=\frac{35}{49}$ (28) $\frac{}{7}=\frac{27}{63}$
(29) $\frac{12}{16}=\frac{3}{}$ (30) $\frac{21}{36}=\frac{7}{}$ (31) $\frac{33}{44}=\frac{3}{}$ (32) $\frac{64}{72}=\frac{}{9}$

**Rule :** *A fraction can always be written more simply, if we can divide both numerator and denominator by the same number.*

*Example.* Thus, take $\frac{12}{20}$.

We can divide both **12** and **20** by **4** and write $\frac{12}{20}$ more simply as $\frac{3}{5}$.

## EXERCISES 11

Write the following fractions as simply as you can

(1) $\frac{9}{12}$ (2) $\frac{10}{15}$ (3) $\frac{18}{24}$ (4) $\frac{24}{36}$ (5) $\frac{36}{42}$ (6) $\frac{36}{60}$
(7) $\frac{21}{28}$ (8) $\frac{21}{30}$ (9) $\frac{10}{30}$ (10) $\frac{11}{30}$ (11) $\frac{24}{33}$ (12) $\frac{24}{35}$
(13) $\frac{6}{9}$ (14) $\frac{7}{9}$ (15) $\frac{11}{16}$ (16) $\frac{12}{16}$ (17) $\frac{20}{25}$ (18) $\frac{21}{25}$
(19) $\frac{16}{18}$ (20) $\frac{12}{18}$ (21) $\frac{7}{18}$ (22) $\frac{22}{33}$ (23) $\frac{21}{33}$ (24) $\frac{20}{33}$

## COMPARISON OF FRACTIONS

Suppose we wish to find which is greater, $\frac{4}{7}$ or $\frac{3}{5}$.

We can draw two equal *lines* on squared paper, A and B shown in Fig. 2 overleaf, each equal to **35** small divisions.

Divide line A up into **7** equal parts (each part will be **5** divisions). Take AX equal to **4** of these parts.

Then AX$=\frac{4}{7}$.

Next divide line B up into **5** equal parts and mark off AY equal to **3** of them.

Then BY$=\frac{3}{5}$.

The figure shows that BY is longer than AX.

So, $\frac{5}{8}$ is greater than $\frac{4}{7}$.

We can also tell from the diagram that the difference is $\frac{7}{35}$ (because each division of the squared paper is $\frac{1}{35}$).

In Fig. 2 why did we make the two lines equal to **35** divisions?

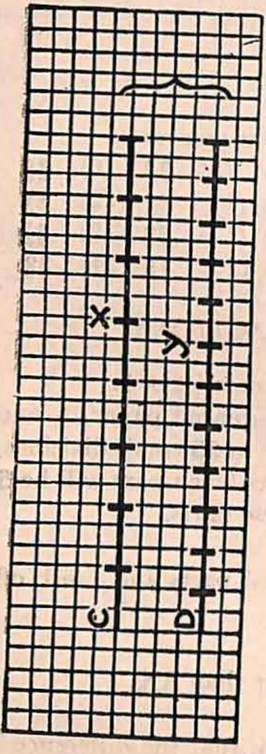

FIG. 1

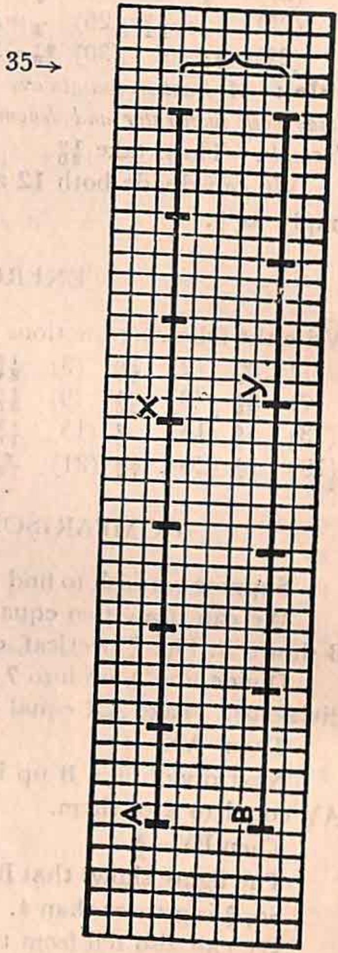

FIG. 2

Suppose, again we wish to find out which is greater, $\frac{5}{8}$ or $\frac{7}{12}$.

We take two lines C and D in Fig. 1, each equal to **24** divisions.

We divide C into eight equal parts. Each part will be equal to **3** divisions. CX is taken equal to **5** parts.

So, $CX = \frac{5}{8}$.

We divide D into twelve equal parts. Each part will be equal to **2** divisions. DY is taken equal to **7** parts.

So, $DY = \frac{7}{12}$.

We see from the diagram that XC is longer.

So, $\frac{5}{8}$ is greater than $\frac{7}{12}$

How much greater? (Notice that each division of the graph paper is $\frac{1}{24}$.)

## EXERCISES 12

1. What two fractions do the lines E and F (Fig. 3) (see page 17) compare?

2. What three fractions do the lines G, H, J (Fig. 4) compare?

3. Draw diagrams to compare the following pairs of fractions :

(*a*) $\frac{3}{4}$; $\frac{4}{5}$ (*b*) $\frac{5}{8}$; $\frac{2}{3}$ (*c*) $\frac{5}{8}$; $\frac{7}{12}$ (*d*) $\frac{9}{16}$; $\frac{7}{12}$ (*e*) $\frac{3}{8}$; $\frac{4}{11}$

Before we can add or subtract fractions we must write them with same denominator.

| (1) | (2) | (3) |
|---|---|---|
| $\frac{5}{12}+\frac{3}{8}$ | $\frac{5}{12}+\frac{3}{8}$ | $\frac{5}{12}+\frac{3}{8}$ |
| $=\frac{40}{96}+\frac{36}{96}$ | $=\frac{20}{48}+\frac{18}{48}$ | $=\frac{10}{24}+\frac{9}{24}$ |
| $=\frac{76}{96}$ | $=\frac{38}{48}$ | $=\frac{19}{24}$ |
| $=\frac{19}{24}$ | $=\frac{19}{24}$ | |

In (1) we have written both fractions as *ninety-sixths.*

(2) we have written both fractions as *forty-eighths.*

(3) we have written both fractions as *twenty-fourths.*

Any one of these ways will do. They all give the same answer.

The third way, however, is the simplest. In the third way we have chosen the *smallest* denominator that will do.

We can find the smallest suitable denominator thus :

Take the smaller denominator, **8**, and see if it will divide exactly into **12**—No. Next see if it will divide exactly into **12** or **24**—Yes. **24** is the smallest suitable denominator.

Another example: Take $\frac{2}{9}$ and $\frac{5}{12}$
Will **9** divide exactly into **12**? No.
Will **9** ,, ,, into **2**×**12** or **24**? No.
Will **9** ,, ,, into **3**×**12** or **36**? Yes.
**36** is the smallest suitable denominator.

Then

$$\frac{2}{9}+\frac{5}{12}$$
$$=\frac{8}{36}+\frac{15}{36}$$
$$=\frac{23}{36}\ \textit{Ans.}$$

Also

$$\frac{5}{12}-\frac{2}{9}$$
$$=\frac{15}{36}-\frac{8}{36}$$
$$=\frac{7}{36}\ \textit{Ans.}$$

## EXERCISES 13

(1) $\frac{3}{8}+\frac{1}{12}$ (2) $\frac{5}{9}+\frac{5}{12}$ (3) $\frac{3}{8}+\frac{2}{5}$ (4) $\frac{3}{4}+\frac{2}{5}$
(5) $\frac{3}{8}+\frac{5}{12}$ (6) $\frac{4}{9}+\frac{3}{8}$ (7) $\frac{4}{9}+\frac{5}{6}$ (8) $\frac{5}{6}+\frac{3}{8}$
(9) $\frac{5}{12}-\frac{2}{9}$ (10) $\frac{7}{18}-\frac{3}{12}$ (11) $\frac{1}{5}-\frac{1}{6}$ (12) $\frac{1}{3}-\frac{1}{7}$
(13) $\frac{3}{8}-\frac{1}{6}$ (14) $\frac{8}{15}-\frac{3}{10}$ (15) $\frac{3}{5}-\frac{2}{10}$ (16) $\frac{7}{8}-\frac{7}{10}$
(17) $\frac{7}{12}+\frac{7}{10}$ (18) $\frac{3}{10}-\frac{2}{15}$ (19) $\frac{4}{5}+\frac{4}{9}$ (20) $\frac{5}{6}+\frac{5}{9}$

*Example* $3\frac{5}{6}+4\frac{4}{9}$

$=7+\frac{5}{6}+\frac{4}{9}$ First adding the whole numbers.
$=7+\frac{15}{18}+\frac{8}{18}$
$=7+\frac{23}{18}$
$=7+1\frac{5}{18}$
$=8\frac{5}{18}$ *Ans.*

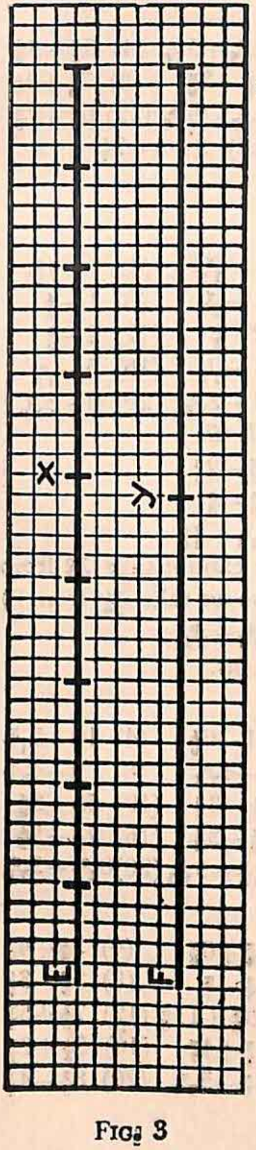

FIG. 3

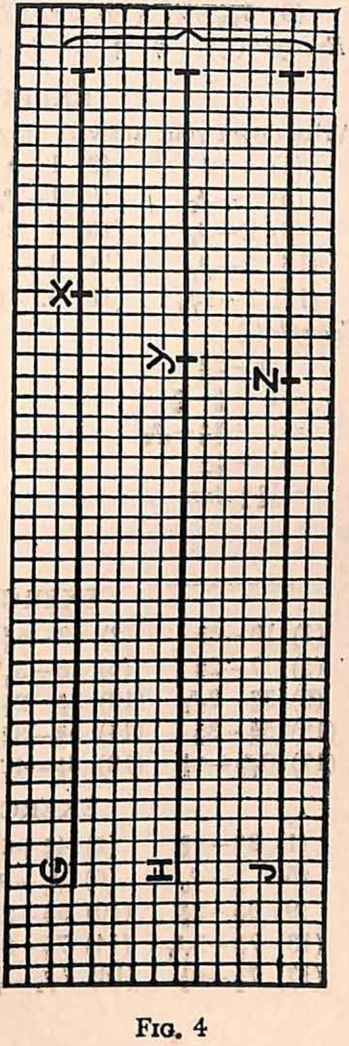

FIG. 4

## EXERCISES 14

(1) $3\frac{1}{12}+2\frac{5}{6}$ (2) $4\frac{1}{2}+5\frac{3}{10}$ (3) $4\frac{1}{12}+5\frac{3}{10}$ (4) $6\frac{2}{5}+3\frac{1}{4}$
(5) $2\frac{5}{6}+5\frac{2}{7}$ (6) $2\frac{5}{7}+3\frac{2}{5}$ (7) $7\frac{1}{6}+3\frac{3}{8}$ (8) $7\frac{3}{4}+2\frac{5}{6}$
(9) $3\frac{5}{12}+2\frac{5}{6}$ (10) $3\frac{5}{12}+2\frac{5}{12}$ (11) $4\frac{3}{10}+5\frac{4}{15}$ (12) $6\frac{2}{9}+7\frac{3}{9}$

*Example* (*i*) $1-\frac{3}{7}=\frac{4}{7}$ (*ii*) $2-\frac{3}{7}=1\frac{4}{7}$ (*iii*) $3-\frac{3}{7}=2\frac{4}{7}$

## EXERCISES 15

Write down your answers only

(1) $1-\frac{3}{7}$ (2) $1-\frac{4}{7}$ (3) $1-\frac{5}{12}$ (4) $1-\frac{11}{12}$
(5) $1-\frac{4}{11}$ (6) $1-\frac{9}{16}$ (7) $1-\frac{7}{20}$ (8) $1-\frac{4}{9}$
(9) $2-\frac{4}{11}$ (10) $2-\frac{3}{7}$ (11) $2-\frac{3}{8}$ (12) $2-\frac{5}{9}$
(13) $3-\frac{4}{11}$ (14) $3-\frac{5}{7}$ (15) $4-\frac{5}{12}$ (16) $5-\frac{9}{16}$
(17) $3-1\frac{7}{11}$ (18) $42-\frac{5}{7}$ (19) $4-2\frac{5}{12}$ (20) $6-3\frac{2}{10}$

*Example* (*i*)

$3\frac{5}{6}-2\frac{3}{8}$
$=1+\frac{5}{6}-\frac{3}{8}$
$=1+\frac{20}{24}-\frac{9}{24}$
$=1+\frac{11}{24}$
$=1\frac{11}{24}$ *Ans.*

*Example* (*ii*)

$4\frac{3}{8}-2\frac{5}{6}$
$=2+\frac{3}{8}-\frac{5}{6}$
$=2+\frac{9}{24}-\frac{20}{24}$
(We cannot take $\frac{20}{24}$ from $\frac{9}{24}$, so we take $\frac{20}{24}$ from 2)
$=1+\frac{4}{24}+\frac{9}{24}$
$=1\frac{13}{24}$ *Ans.*

## EXERCISES 16

(1) $10-6\frac{3}{7}$ (2) $12-4\frac{2}{5}$ (3) $11-6\frac{4}{9}$ (4) $10-5\frac{5}{12}$
(5) $7-2\frac{4}{7}$ (6) $8-3\frac{5}{12}$ (7) $8-4\frac{5}{16}$ (8) $9-4\frac{5}{11}$
(9) $3\frac{2}{3}-2\frac{5}{11}$ (10) $3\frac{2}{3}-2\frac{11}{12}$ (11) $5\frac{1}{2}-3\frac{3}{8}$ (12) $5\frac{1}{2}-3\frac{4}{5}$
(13) $5\frac{5}{6}-3\frac{3}{8}$ (14) $5\frac{3}{8}-3\frac{5}{6}$ (15) $7\frac{4}{9}-3\frac{1}{6}$ (16) $7\frac{1}{6}-5\frac{4}{9}$
(17) $6\frac{3}{10}-4\frac{1}{5}$ (18) $6\frac{1}{5}-4\frac{3}{10}$ (19) $8\frac{11}{15}-5\frac{3}{10}$ (20) $8\frac{2}{15}-3\frac{3}{10}$

## EXERCISES 17

(1) $3\frac{2}{3}+4\frac{2}{5}$ (2) $4\frac{3}{8}+6\frac{1}{4}$ (3) $4\frac{3}{8}+6\frac{5}{6}$ (4) $3\frac{1}{8}+4\frac{1}{9}$
(5) $\frac{1}{9}-\frac{1}{10}$ (6) $\frac{1}{10}-\frac{1}{11}$ (7) $\frac{3}{5}-\frac{2}{7}$ (8) $3\frac{2}{5}-3\frac{2}{7}$
(9) $3\frac{2}{7}-2\frac{2}{5}$ (10) $5\frac{2}{7}+2\frac{3}{6}$ (11) $13\frac{3}{8}+11\frac{5}{6}$ (12) $7\frac{1}{5}+5\frac{1}{7}$
(13) $7\frac{1}{2}+3\frac{3}{10}$ (14) $7\frac{1}{2}+3\frac{7}{10}$ (15) $5\frac{5}{6}+4\frac{3}{7}$ (16) $5\frac{4}{5}+2\frac{3}{7}$
(17) $7\frac{1}{2}-4\frac{1}{5}$ (18) $7\frac{7}{10}-\frac{5}{12}$ (19) $7\frac{5}{1}-5\frac{7}{16}$ (20) $8\frac{1}{5}-4\frac{1}{7}$

## PROBLEMS ON ADDITION AND SUBTRACTIONS OF FRACTIONS

### EXERCISES 18

(1) A stick $\frac{3}{4}$ m. long is broken in two. One part is $\frac{2}{3}$ m. long. How long is the other part?

(2) I buy a cake and eat $\frac{5}{12}$ of it. What fraction is left?

(3) The weights of 3 parcels are $2\frac{3}{4}$ kg, $1\frac{5}{8}$ kg, $3\frac{5}{16}$ kg, respectively. What is the total weight?

(4) Two towns are $3\frac{5}{8}$ km. apart. A bridge on the road between them is $2\frac{1}{6}$ km. from one town. How far is it from the other town?

(5) Harold has $\frac{2}{3}$ of his story book left to read. How much will he have left after he has read $\frac{1}{6}$ more?

(6) The blade of a bat is $\frac{3}{7}$m., and the handle $\frac{1}{5}$ m· How ong is the bat?

(7) A boy spent $\frac{3}{8}$ of his holidays at home, $\frac{3}{16}$ at a friend's place and the rest at a scout's camp. What fraction of his holiday did he spend at camp?

(8) Add $\frac{2}{3}$ to the difference between $3\frac{1}{4}$ and $2\frac{1}{6}$.

(9) Subtract $1\frac{1}{4}$ from the sum of $3\frac{5}{6}$ and $2\frac{1}{6}$.

(10) When I have travelled 8 km, I have done $\frac{2}{5}$ of my journey. What is the length of my journey?

(11) When I have travelled 15 km, I have done $\frac{5}{12}$ of my journey. What is the length of my journey?

(12) A boy spends $\frac{1}{5}$ of his pocket money on sweets and $\frac{1}{3}$ on a toy and has Rs. 15 left. How much had he at first?

(13) A boy spends $\frac{1}{6}$ of his money on a book and $\frac{2}{3}$ on fruits and has Rs. 10 left. How much had he at first?

## PROBLEMS ON ADDITION AND SUBTRACTION OF FRACTIONS

(14) $\frac{3}{5}$ of a school are boys and the rest are girls. What fractions of the school are girls? If there are 124 girls, what is the number of boys?

(15) A tin holds 3 litres of water. How much must I pour out so as to have $1\frac{3}{7}$ litres in the tin?

(16) A 2 kg. cake was divided among 5 boys and a 3 kg cake was divided among 7 girls. Who got more, a boy or a girl? How much more?

(17) The perimeter of a rectangular card is 30 cm. If its width is $7\frac{3}{4}$ cm., find its length.

(18) A tub is $\frac{1}{3}$ full. If I draw out 9 litres it is quarter full. How much will the tub hold?

(19) A tub is $\frac{1}{3}$ full. If I draw out 12 litres it is one-sixth full. How much will the tub hold?

(20) A, B and C buy a radio. A pays $\frac{11}{20}$ of the cost, B pays $\frac{7}{20}$ of it. What fraction of it does C pay? If C pays Rs. 125, what did the radio cost?

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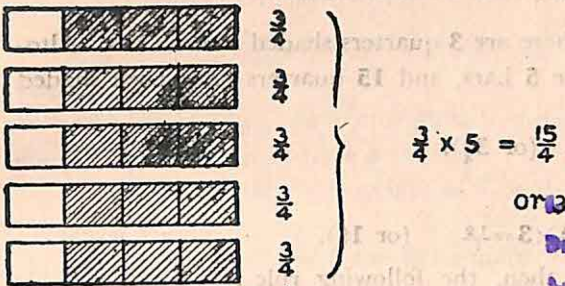

FIG. A

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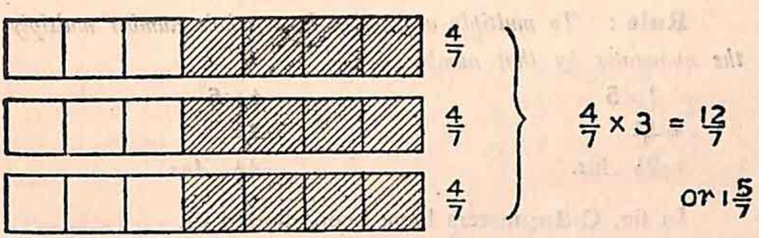


FIG. B

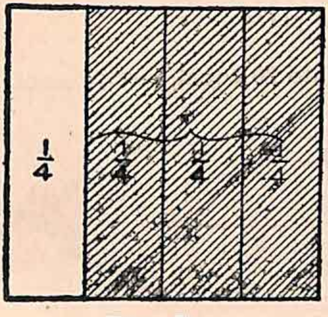


FIG. C

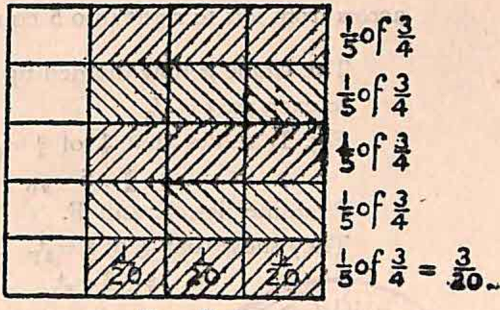


FIG. D

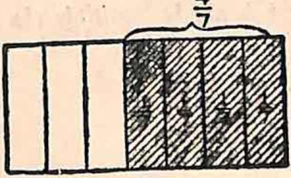


FIG. E

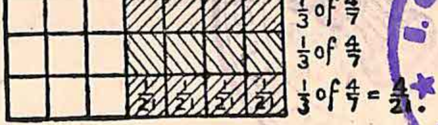


FIG. F

## MULTIPLICATION AND DIVISION OF A FRACTION BY A WHOLE NUMBER

In fig. A there are **3** quarters shaded in each bar. Altogether there are **5** bars, and **15** quarters have been shaded in.

$\frac{3}{4}\times\mathbf{5}=\frac{15}{4}$ (or $3\frac{3}{4}$).

Examine fig. B.

It shows that $\frac{4}{7}\times\mathbf{3}=\frac{12}{7}$ (or $\mathbf{1}\frac{5}{7}$).

We have, then, the following rule :

**Rule :** *To multiply a fraction by a whole number multiply the numerator by that number.*

| | |
|---|---|
| $\frac{3}{7}\times\mathbf{5}$ | $\frac{4}{5}\times\mathbf{6}$ |
| $=\frac{15}{7}$ | $=\frac{24}{5}$ |
| $=2\frac{1}{7}$ *Ans.* | $=4\frac{4}{5}$ *Ans.* |

In fig. C **3** quarters have been shaded in.

In fig. D each quarter is divided up by lines drawn across from left to right into **5** equal parts.

The whole is now divided up into **20** equal parts;
so each part is $\frac{1}{20}$
Fig. D shows that $\frac{1}{5}$ of $\frac{3}{4}=\frac{3}{20}$
or $\frac{3}{4}\div\mathbf{5}=\frac{3}{20}$
Examine figs. E and F.
They show that $\frac{1}{3}$ of $\frac{4}{7}=\frac{4}{21}$
or $\frac{4}{7}\div\mathbf{3}=\frac{4}{21}$

We have then the following rule :

**Rule :** *To divide a fraction by a whole number multiply the denominator by that number.*

| | |
|---|---|
| $\frac{3}{7}\div\mathbf{5}$ | $\frac{4}{5}\div\mathbf{3}$ |
| $=\frac{3}{35}$ *Ans.* | $=\frac{4}{15}$ *Ans.* |

## EXERCISES 19

(1) If $\frac{3}{4}$ of a cake is divided among 5 boys, what will each boy get?

(2) How many metres of ribbon will be required for 6 girls if each girl is to have $\frac{3}{4}$ metre?

(3) What is the total weight of 7 books, each of which weighs $\frac{5}{8}$ kg.?

(4) What is the perimeter of a square of side $\frac{5}{9}$ m. ?

(5) What is the perimeter of a rectangle $\frac{3}{8}$ m. long and $\frac{3}{8}$ m. wide?

(6) (a) $\frac{2}{3}\times 7$ (b) $\frac{3}{8}\times 5$ (c) $\frac{7}{16}\times 9$ (d) $\frac{2}{3}\div 7$
(e) $\frac{3}{8}\div 5$ (f) $\frac{7}{16}\div 9$ (g) $\frac{4}{7}\times 3$ (h) $\frac{4}{7}\div 3$
(i) $\frac{4}{9}\div 5$ (j) $\frac{4}{9}\times 5$ (k) $\frac{5}{12}\div 3$ (l) $\frac{5}{12}\times 7$

*Example* (i) $\frac{5}{12}\times 3$. $\frac{5}{\underset{4}{\cancel{12}}}\times\cancel{3}=\frac{5}{4}$ (cancelling)

*Example* (ii) $\frac{9}{11}\div 6=\frac{9}{11}\div\frac{6}{1}=\frac{\overset{3}{\cancel{9}}}{11}\div\frac{1}{\underset{2}{\cancel{6}}}=\frac{3}{11}\times\frac{1}{2}=\frac{3}{22}$

(7) (a) $\frac{4}{9}\times 6$ (b) $\frac{5}{8}\div 4$ (c) $\frac{7}{16}\times 12$ (d) $\frac{6}{7}\div 6$
(e) $\frac{9}{16}\div 6$ (f) $\frac{8}{15}\div 12$ (g) $\frac{11}{25}\times 10$ (h) $\frac{13}{14}\times 7$
(i) $\frac{4}{5}\times 5$ (j) $\frac{8}{9}\div 14$ (k) $\frac{7}{12}\div 14$ (l) $\frac{8}{13}\div 32$

## EXERCISES 20

(1) A stick $\frac{3}{8}$ metre long is cut into 3 equal parts. How long is each part?

(2) A stick $\frac{7}{8}$ metre long is cut into 5 equal parts. How ong is each part?

(3) A line is $5\frac{1}{2}$ cm long. If it is divided into 11 equal parts, what is the length of each part?

(4) A line is $7\frac{1}{2}$ cm. long. If it is divided into 3 equal parts, what is the length of each part?

(5) Five sticks are each $3\frac{5}{8}$ cm. long. If they are joined together, what is the whole length?

(6) A stick is cut up into 8 equal pieces of length $3\frac{5}{8}$ cm, what is the length of the stick?

(7) Three boys share a rope $7\frac{1}{8}$ metres long. What length will each boy get?

(8) $4\frac{1}{2}$ kg. of sweets are to be divided equally among 9 boys. How much will each boy receive?

(9) $4\frac{1}{2}$ kg. of chocolate are to be divided equally among 6 girls. How much will each girl get?

(10) How many kg of sweets will be required so that 8 boys get $\frac{3}{8}$ kg each?

(11) How many kg. of sugar will be required so that 12 boys get $\frac{3}{4}$ kg. each?

(12) A man walks $4\frac{3}{4}$ km. in 1 hour. How far will he walk in 3 hours?

## EXERCISES 21

(1) How many $\frac{1}{2}$ metre lengths can be cut from 8 metres of ribbon?

(2) How many $\frac{1}{4}$ kg. bags of sweets will weigh 10 kg.?

(3) How many $\frac{1}{8}$ litre cans can be filled from a jar containing 12 litres of oil?

(4) How many kilometres can a man walk in 7 hours if he walks $\frac{1}{2}$ km. each hour?

(5) A lump of iron weighing 9 kg. is to be melted down and moulded into small cubes. How many cubes can be got if each cube is to weigh $\frac{1}{8}$ kg?

(6) If each girl is to have $\frac{1}{8}$ kg. of chocolates, how many girls can share 7 kg. of chocolates?

(7) How many pieces $\frac{1}{12}$ metre long can be cut from a pole 8 metres long?

(8) Lamp posts are to be placed along a road $\frac{1}{5}$ km. apart. How many posts will be needed if the road is 7 km long?

## DIVISION BY A FRACTION

### EXERCISES 22

Fill in the missing numbers indicated by dots :

1. There are .. $\frac{1}{5}$'s in **4**; so $\mathbf{4} \div \frac{1}{5} =$ ..
2. ,, ,, .. $\frac{1}{3}$'s in **5**; so $\mathbf{5} \div \frac{1}{3} =$ ..
3. ,, ,, .. $\frac{1}{6}$'s in **3**; so $\mathbf{3} \div \frac{1}{6} =$ ..
4. ,, ,, .. $\frac{1}{5}$'s in **7**; so $\mathbf{7} \div \frac{1}{5} =$ ..
5. ,, ,, .. $\frac{1}{4}$'s in **6**; so $\mathbf{6} \div \frac{1}{4} =$ ..
6. ,, ,, .. $\frac{1}{3}$'s in **7**; so $\mathbf{7} \div \frac{1}{3} =$ ..
7. ,, ,, .. $\frac{1}{5}$'s in **8**; so $\mathbf{8} \div \frac{1}{5} =$ ..
8. ,, ,, .. $\frac{1}{7}$'s in **4**; so $\mathbf{4} \div \frac{1}{7} =$ ..

The right hand column reads :

1. $\mathbf{4 \div \frac{1}{5} = 20}$
2. $\mathbf{5 \div \frac{1}{3} = 15}$
3. $\mathbf{3 \div \frac{1}{6} = 18}$
4. $\mathbf{7 \div \frac{1}{5} = 35}$

and so on.

These show that $\mathbf{4 \div \frac{1}{5}}$ is the same as $\mathbf{4 \times 5}$

$\mathbf{5 \div \frac{1}{3}}$ ,, ,, $\mathbf{5 \times 3}$

$\mathbf{3 \div \frac{1}{6}}$ ,, ,, $\mathbf{3 \times 6}$

$\mathbf{7 \div \frac{1}{5}}$ ,, ,, $\mathbf{7 \times 5}$

We see then that the rule is :

**Rule :** *To divide by a fraction, multiply by its reciprocal*

or

*To divide by a fraction, invert it and multiply.*

*Example (i)*

$$\frac{3}{7} \div \frac{1}{5} = \frac{3}{7} \times \frac{5}{1}$$
$$= \frac{15}{7}$$
$$= 2\frac{1}{7} \textit{ Ans.}$$

*Example (ii)*

$$\frac{3}{7} \div \frac{4}{5} = \frac{3}{7} \times \frac{5}{4}$$
$$= \frac{15}{28} \textit{ Ans.}$$

## DIVISION BY A FRACTION

*Example (iii)*

$$\frac{4}{5} \div \frac{2}{3} = \frac{4}{5} \times \frac{3}{2}$$
$$= \frac{4}{5} \times \frac{3}{2}$$
$$= \frac{6}{5}$$
$$= 1\frac{1}{5} \textit{ Ans.}$$

*Example (iv)*

$$\frac{3}{5} \div \frac{7}{10} = \frac{3}{5} \times \frac{10}{7}$$
$$= \frac{6}{7} \textit{ Ans.}$$

### EXERCISES 23

(1) $\frac{4}{11} \div \frac{3}{5}$ (2) $\frac{3}{7} \div \frac{1}{6}$ (3) $\frac{3}{5} \div \frac{1}{7}$ (4) $\frac{3}{5} \div \frac{3}{7}$
(5) $5 \div \frac{5}{6}$ (6) $\frac{5}{8} \div \frac{5}{6}$ (7) $\frac{5}{8} \div \frac{3}{4}$ (8) $\frac{4}{11} \div \frac{4}{7}$
(9) $\frac{6}{7} \div \frac{3}{14}$ (10) $\frac{1}{2} \div \frac{1}{4}$ (11) $\frac{3}{4} \div \frac{2}{3}$ (12) $\frac{4}{7} \div \frac{5}{9}$

*Example*

$$3\frac{3}{4} \div 1\frac{3}{7} = \frac{15}{4} \div \frac{10}{7}$$
$$= \frac{\overset{3}{\cancel{15}}}{4} \times \frac{7}{\underset{2}{\cancel{10}}}$$
$$= \frac{21}{8}$$
$$= 2\frac{5}{8} \textit{ Ans.}$$

### EXERCISES 24

(1) $\frac{1}{2} \div 1\frac{1}{4}$ (2) $3\frac{1}{2} \div 1^{1}$ (3) $3\frac{1}{2} \div 1\frac{3}{4}$ (4) $1\frac{2}{5} \div 5\frac{1}{4}$
(5) $2\frac{2}{5} \div \frac{9}{7}$ (6) $2\frac{1}{8} \div 3\frac{1}{2}$ (7) $2\frac{1}{2} \div 3\frac{1}{3}$ (8) $3\frac{4}{5} \div 1\frac{2}{5}$
(9) $3\frac{2}{3} \div 5\frac{1}{2}$ (10) $5\frac{2}{5} \div 1^{4}$, (11) $5\frac{2}{5} \div 2\frac{1}{4}$ (12) $7\frac{1}{8} \div 2\frac{3}{4}$
(13) $1\frac{1}{8} \div 1\frac{1}{9}$ (14) $1\frac{1}{9} \div 1\frac{1}{8}$ (15) $7\frac{1}{2} \div 6\frac{2}{3}$ (16) $3\frac{4}{7} \div 4\frac{3}{4}$
(17) $6\frac{4}{5} \div 5\frac{2}{3}$ (18) $5\frac{2}{3} \div 6\frac{4}{5}$ (19) $4\frac{1}{3} \div 3\frac{5}{7}$ (20) $4\frac{2}{7} \div 1\frac{1}{14}$

## EXERCISES 25

(1) A cake weighs $2\frac{1}{4}$ kg. How much does $\frac{2}{3}$ cake weigh?

(2) A piece of string is $2\frac{2}{3}$ m. long. How long will $\frac{3}{4}$ of a piece be?

(3) There are 65 pieces of toffee to the kilogram. How many pieces are there in $3\frac{2}{5}$ kg.?

(4) Which is heavier $\frac{2}{3}$ of a $1\frac{1}{2}$ kg. cake or $\frac{3}{5}$ of a $1\frac{1}{4}$ kg. cake?

(5) Add $\frac{2}{5}$ of $2\frac{1}{2}$ to $\frac{3}{4}$ of $\frac{8}{15}$.

(6) Which is longer $\frac{4}{5}$ of a line $7\frac{1}{2}$ cm. long or $\frac{3}{8}$ of a line 16 cm. long?

(7) $\frac{3}{5}$ of a cake weighs 1 kg. What does the whole weigh?

(8) $\frac{4}{7}$ of a cake weighs 2 kg. What does the whole weigh?

(9) $\frac{4}{7}$ of a cake weighs $2\frac{1}{2}$ kg. What does the whole weigh?

(10) $\frac{3}{8}$ of a cake weighs $\frac{3}{4}$ kg. What does the whole weigh?

(11) $\frac{3}{8}$ of boy's pocket money is Rs. 8. How much pocket money does the boy get?

(12) A boy spends $\frac{3}{5}$ of his pocket money shopping and has Rs. 4 left. How much pocket money does he get?

(13) $\frac{7}{15}$ of a man's salary is Rs. 112. What is the man's salary?

(14) A man does $\frac{4}{9}$ of his journey by train and the remainder by car. If the car journey is 125 miles, what is the total length of the journey?

(15) A boy spends Rs. 6 on a shirt and has $\frac{2}{5}$ of his money left. How much had he at first?

**Rule :**

When simplifying fractions remember ÷ should be worked first, then × and then + and —. Brackets must be worked before ÷, ×, +, and —.

*Example* (*i*) $\frac{1}{4}\times\frac{3}{5}+\frac{7}{10}$

$=\frac{3}{20}+\frac{7}{10}$

$=\frac{3+14}{20}$

$=\frac{17}{20}$ *Ans.*

*Example* (*ii*) $\frac{1}{4}\times(\frac{3}{5}+\frac{7}{10})$

$=\frac{1}{4}\times(\frac{6+7}{10})$

$=\frac{1}{4}\times\frac{13}{10}$

$=\frac{13}{40}$

(The fractions inside the brackets were first simplified into ONE fraction).

*Example* (*iii*) $\frac{3}{8} \div 1\frac{7}{8} - \frac{1}{6}$

$= \frac{3}{8} \div \frac{15}{8} - \frac{1}{6}$

$= \frac{\cancel{3}^{1}}{\cancel{8}_{1}} \times \frac{\cancel{8}^{1}}{\cancel{15}_{5}} - \frac{1}{6}$

$= \frac{1}{5} - \frac{1}{6}$

$= \frac{6-5}{30}$

$= \frac{1}{30}$ *Ans.*

*Example* (*iv*) $\frac{3}{8} \div (1\frac{7}{8} - \frac{1}{8})$

$= \frac{3}{8} \div (1 + \frac{7}{8} - \frac{1}{6})$

$= \frac{3}{8} \div (1 + \frac{21-4}{24})$

$= \frac{3}{8} \div 1\frac{17}{24}$

$= \frac{3}{8} \div \frac{41}{24}$

$= \frac{3}{8} \times \frac{24}{41}$

$= \frac{9}{41}$ *Ans.*

## EXERCISES 26

Simplify :

(1) $\frac{3}{8} + \frac{5}{8} \times \frac{3}{10}$

(2) $(\frac{3}{8} + \frac{5}{6}) \times \frac{3}{10}$

(3) $\frac{8}{9} \times 1\frac{1}{8} + \frac{1}{2}$

(4) $\frac{3}{9} \times (1\frac{1}{3} + \frac{1}{2})$

(5) $\frac{3}{8} \times \frac{5}{6} \div 3\frac{1}{3}$

(6) $\frac{3}{9} \div \frac{5}{6} \times 3\frac{1}{3}$

(7) $(\frac{3}{5} + \frac{1}{3}) \div \frac{2}{3}$

(8) $\frac{3}{5} + \frac{1}{3} \div \frac{2}{3}$

(9) $\frac{1}{2} \times \frac{1}{3} + \frac{1}{4} \times \frac{1}{5}$

(10) $\frac{1}{2} \times (\frac{1}{3} + \frac{1}{4}) \times \frac{1}{5}$

(11) $1\frac{5}{6} \div 2\frac{3}{4} - \frac{1}{4}$

(12) $1\frac{5}{6} \div (2\frac{3}{4} - \frac{1}{4})$

(13) $1\frac{5}{6} \div 2\frac{3}{4} \times \frac{4}{11}$

(14) $(2\frac{3}{8} - \frac{1}{6}) \div \frac{5}{24}$

(15) $2\frac{3}{8} - \frac{1}{6} \div \frac{5}{24}$

(16) $\frac{7}{10} \div 3\frac{1}{2} - \frac{1}{5}$

(17) $\frac{7}{10} \div (3\frac{1}{2} - \frac{1}{5})$

(18) $2\frac{5}{12} + 1\frac{1}{5} \div 1\frac{4}{5}$

(19) $2\frac{5}{12} + \frac{3}{5} \div 1\frac{1}{2}$

(20) $(\frac{2}{9} + \frac{5}{12}) \times \frac{12}{23}$

(21) $\frac{7}{15} \times (3 - \frac{3}{11})$

(22) $\frac{3}{4} \times \frac{2}{9} + \frac{1}{3} \div 2\frac{1}{2}$

(23) $\frac{3}{4} \times (\frac{2}{9} + \frac{1}{3}) \div 2\frac{1}{2}$

(24) $\frac{3}{7} \times \frac{28}{39} \div 3\frac{1}{4}$

(25) $(\frac{1}{2} + \frac{1}{3}) \times (\frac{1}{5} - \frac{1}{6})$

## Miscellaneous Fractions

Simplify :

(1) $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} - \frac{1}{6}$

(2) $\frac{1}{2} + \frac{1}{3} \div \frac{1}{4} \times \frac{1}{6}$

(3) $1\frac{1}{9} \div 2\frac{1}{12}$

(4) $\frac{14}{27} \div \frac{38}{91}$

(5) $1\frac{2}{5} \div 4\frac{1}{5}$

(6) $\dfrac{3\frac{3}{8}}{5\frac{1}{8}}$

(7) $\dfrac{1\frac{5}{7}}{1\frac{2}{7}}$

(8) $\dfrac{1}{\frac{5}{9}}$

(9) $\dfrac{1}{\frac{3}{4}}$

(10) $\dfrac{\frac{3}{5}}{\frac{5}{6}}$

(11) $\frac{3}{8}\times\frac{5}{12}\times3\frac{1}{3}\times\frac{1}{3}$

(12) $\frac{4}{9}\times\frac{15}{16}\div\frac{5}{12}$

(13) $\frac{1}{2}\times4\frac{2}{5}-\frac{1}{3}\times\frac{2}{10}$

(14) $\frac{1}{2}-\frac{1}{3}\div\frac{1}{4}+\frac{11}{12}$

(15) $(\frac{1}{2}-\frac{1}{3})\div(\frac{1}{4}+\frac{11}{12})$

(16) $(\frac{1}{2}-\frac{1}{3})\div\frac{1}{4}+\frac{11}{12}$

(17) $\frac{1}{2}-\frac{1}{3}\div(\frac{1}{4}+\frac{11}{12})$

(18) $3\frac{1}{2}-\frac{2}{3}\times1\frac{4}{5}$

(19) $(\frac{1}{2}+\frac{1}{9})\div(\frac{1}{4}+\frac{1}{6})$

(20) $\frac{3}{4}\times2\frac{2}{3}-\frac{2}{3}\times2\frac{1}{4}$

(21) $(3\frac{1}{2}-1\frac{1}{2})\div\frac{2}{3}$

(22) $(4\frac{1}{2}-1\frac{1}{2})\times\frac{1}{3}$

(23) $\frac{33}{14}\times\frac{63}{5}\div13\frac{1}{5}$

(24) $\frac{6}{35}\times\frac{8}{63}\div2\frac{2}{9}$

(25) $1\frac{4}{13}\times7\frac{4}{5}\div11\frac{1}{3}$

(26) $1-\frac{1}{3}\times(\frac{1}{2}+\frac{2}{5})$

(27) $(\frac{1}{3}+\frac{3}{11})\times(\frac{1}{5}+\frac{3}{7})$

(28) $\frac{1}{2}\times\frac{3}{4}\div\frac{9}{16}$

(29) $1\div(\frac{1}{4}-\frac{1}{5})$

(30) $(\frac{1}{4}+\frac{1}{9})\div(\frac{2}{3}-\frac{1}{8})$

(31) If $\frac{2}{5}$ of a certain sum of money is Rs. 42, what is the value of $\frac{3}{7}$ of it?

(32) If $\frac{2}{3}$ of a stick is 48 metres long, what is the length of three quarters of the rest of it?

(33) The product of two numbers is $3\frac{1}{2}$; one of them is $2\frac{1}{3}$. Find the other number. What is the sum of the two numbers?

(34) Which is greater $3\div4\frac{1}{2}$ or $2\div3\frac{1}{4}$ and by how much?

(35) If $\frac{4}{9}$ of my holiday cost Rs. 140, what will the rest to my holiday cost?

## DECIMALS

A decimal is a fraction whose denominator is 10 or power of 10.

*Examples* $\frac{1}{10}=\cdot1$; $\frac{1}{10^2}=\frac{1}{100}=\cdot01$

$$\frac{1}{10^3}=\frac{1}{1000}=.0001$$

.1 is one tenth.

.01 is one hundredth.

·0001 is one thousandth.

Read the table given below and write your answers as shown below.

| | Thousands | Hundreds | Tens | Units | Tenths | Hundre-dths | Thousan-dths | |
|---|---|---|---|---|---|---|---|---|
| (1) | | | | 2 | 5 | | | *Ans* 2·5 |
| (2) | | | | | 7 | | | |
| (3) | | | | 3 | 2 | 5 | | |
| (4) | | | | 4 | 0 | 8 | | |
| (5) | | | | | 5 | 6 | | |
| (6) | | | | | | 7 | | *Ans*. 0.07 |
| (7) | | | 3 | 1 | 5 | 7 | | |
| (8) | | | | | | 8 | 7 | |
| (9) | | | 5 | 3 | 0 | 2 | 6 | |
| (10) | | 6 | 5 | 1 | 0 | 2 | 3 | |
| (11) | 1 | | 4 | | 7 | | 3 | *Ans*. 1040.703 |
| (12) | 1 | | 2 | 3 | | 4 | 5 | |
| (13) | | 3 | | 7 | | 7 | 1 | |
| (14) | 2 | 1 | 5 | 4 | 3 | 2 | 5 | |
| (15) | 7 | | | 4 | 1 | | 6 | |
| (16) | 7 | | | | | | 4 | |

Make your own table as shown above and show in it the following :—
(17) 3.54 (18) 5.07 (19) 0.6 (20) 0.05 (21) 0.008 (22) 12.3 (23) 50.3 (24) 50.05 (25) 6.032 (26) 7.004 (27) 118.014 (28) 4 tenths (29) 5 hundredths (30) 6 thousandths (31) $8+\frac{2}{10}+\frac{3}{100}$ (32) $5+\frac{4}{10}+\frac{5}{1000}$ (33) $4+\frac{9}{10000}$ (34) $307+\frac{7}{100}$ (35) $71+\frac{5}{10}+\frac{5}{1000}$

Write as decimals :
(36) $\frac{5}{10}$; $\frac{4}{100}$; $\frac{9}{1000}$ (37) $\frac{9}{100}$; $\frac{8}{10}$; $\frac{7}{1000}$ (38) $\frac{2}{10}+\frac{3}{100}$ (39) $\frac{4}{10}+\frac{5}{100}+\frac{6}{1000}$ (40) $2+\frac{8}{10}+\frac{3}{100}+\frac{4}{1000}$ (41) $2+\frac{3}{100}+\frac{5}{1000}$ (42) $11+\frac{1}{190}+\frac{1}{1000}$ (43) $5+\frac{2}{10}+\frac{2}{100}\times\frac{7}{1000}$

Write in full as in Nos. 36-43

(44) 0.3; 0.03; 0.0003
(45) 0.01; 0.8; 0.004
(46) 1.1; 1.01; 1.001
(47) 21.12; 22.024; 31.005

## METRIC SYSTEM

10 millimetres (mm) = 1 centimetre (cm)
10 centimetres = 1 decimetre (dm)
10 decimetres = 1 metre (m)
100 cm = 1 metre
1000 mm = 1 metre
$\frac{1}{10}$ metre = 1 decimetre (*deci* means one tenth or ·1)
$\frac{1}{100}$ metre = 1 centimetre (*centi* means $\frac{1}{100}$ or ·01)
$\frac{1}{1000}$ metre = 1 millimetre (*milli* means $\frac{1}{1000}$ or ·001)

Write the following in metres as shown on the right hand side.

| | Metre (m) | Decimetre (dm) | Centimetre (cm) | Millimetre (mm) | |
|---|---|---|---|---|---|
| 1. | 2 | 7 | | | 2·7 m. *Ans.* |
| 2. | 3 | 5 | | | |
| 3. | | 8 | | | |
| 4. | | 7 | 2 | | ·72 m. *Ans.* |
| 5. | | 6 | 5 | | |
| 6. | | | 3 | | 0·3 m. *Ans.* |
| 7. | | | | 4 | |
| 8. | 3 | 5 | 9 | | |
| 9. | | 8 | 6 | | |
| 10. | | | 6 | 8 | |
| 11. | 1 | | 7 | 5 | |
| 12. | | 4 | 5 | 8 | |
| 13. | 7 | 8 | 3 | | |
| 14. | 9 | 2 | 1 | 6 | |
| 15. | | 3 | .. | 4 | |
| 16. | | 5 | .. | 6 | |
| 17. | | | 6 | 5 | |
| 18. | 2 | .. | 3 | 4 | |
| 19. | 1 | 5 | .. | 6 | |
| 20. | 4 | 1 | 5 | 9 | |

21. Write in millimetres the lengths in Nos. 15-20
22. Write in centimetres the lengths in Nos. 1-15.

Small lengths are measured in tenths of a metre, or hundredths of a metre or thousandths of a metre. Large lengths are measured in tens of metres or hundreds of metres or thousands of metres.

10 metres = 1 dekametre (Dm)
10 dekametres = 1 Hectometre (Hm)
10 Hectometres = 1 kilometre (Km)

*Capital letters* D, H and K are used.

1000 metres = 1 kilometre

Millimetres, centimetres, metres and kilometres are most commonly used.

*Example.* Express 5 Km; 4 Hm; 6 Dm; 5 m. in
(a) kilometres (b) in metres (c) in Km and metres.

*Ans.* (*a*) 5·465 Km.
(*b*) 5465 metres.
(*c*) 5 Km. 465 metres.

Write down the following in (i) Km. (ii) metres as shown on the right of the diagram.

| | Km. | Hm. | Dm. | m. | dm. | cm. | mm. |
|---|---|---|---|---|---|---|---|
| (1) | 2 | 3 | 4 | 5 | | | |
| (2) | 4 | | 5 | 6 | | | |
| (3) | 3 | 2 | 5 | | | | |
| (4) | 4 | | | 5 | | | |
| (5) | | 6 | 8 | 7 | | | |
| (6) | | 8 | 2 | 1 | 9 | | |
| (7) | 1 | 2 | 7 | | 5 | | |
| (8) | | 3 | 6 | 4 | 5 | 1 | |
| (9) | | | 5 | | 4 | 3 | |
| (10) | | 2 | 3 | 5 | | 4 | |
| (11) | | 1 | 7 | | 5 | 6 | |
| (12) | | | 5 | 9 | 8 | 7 | 6 |
| (13) | | | 4 | | 8 | | 7 |
| (14) | | 2 | | 6 | 8 | | 9 |
| (15) | 3 | | 4 | 7 | | 5 | 6 |
| (16) | 1 | 2 | | 4 | 3 | | 1 |
| (17) | | 2 | | 1 | | | 4 |

*Ans.* (*i*) 2·345 Km.
(*ii*) 2345m.

*Ans.* (*i*) 0·05043Km.
(*ii*) 50·43 m.

Make a table as shown above, and show in it the following lengths. Then show each length in Km.

(18) 5 Km. 4 Hm. 6 Dm.
(19) 2 Km. 4 Dm. 3 m.
(20) 1 Km. 4 m. 5 dm.
(21) 2 Km. 3 m. 7 dm.
(22) 7 m. 4 dm.
(23) 6 m. 5 dm. 4 cm.
(24) 1 Km. 2 m. 3 cm.
(25) 3 m. 4 cm. 5 mm.
(26) 2 m. 5 cm. 3 mm.
(27) 6 m. 2 dm. 3 mm.
(28) 4 Dm. 5 cm.
(29) 3 m. 5 mm.
(30) 3 Km. 6 cm. 5 mm.

## FURTHER EXERCISES

(1) Express in millimetres : 5 cm. 4 dm. 2 m.; 5 cm. 5 dm.; 7 m.; 4 m. 5 cm.; 9 m. 7 dm. 2 mm.

(2) Express in metres.

5 Dm. 2 m.; 2 Hm. 7 Dm. 4 m.; 1 Km. 2 Dm.; 3 m. 4 dm. 6 m. 5 dm. 3 cm.; 7 m. 9 cm.

(3) Express in kilometres :

2 Km. 4 Hm.; 5 Km. 2 Hm. 6 Dm.; 7 Km. 1 Hm. 6 Dm. 6 m.; 3 Km. 6 Dm; 2 Km. 4 Dm. 5 m.; 4 Dm. 7 m.; 9 m.; 0·9 m.; 9 m. 4 dm.; 9.05 m.

(4) Express in Km. and metres :

3·54 Km.; 4·23 Km.; 7·05 Km.; 2·705 Km.; 9·004 Km.

## MULTIPLICATION OF DECIMALS BY POWERS OF 10

5 tenths × 10 = 5 units ∴ $0{\cdot}5\times 10=5$ *Ans.*

4 hundredths × 10 = 4 tenths ∴ $0{\cdot}04\times 10={\cdot}4$ *Ans.*

8 thousandths × 10 = 8 hundredths ∴ $0{\cdot}008\times 10=0{\cdot}08$

Therefore to multiply a decimal by 10 we move the *decimal* point 1 place to the *right.*

If we multiply by 100 it is the same as multiplying by $10\times 10$

$0{\cdot}254\times 100=0{\cdot}254\times 10\times 10=2{\cdot}54\times 10=15{\cdot}4$ *Ans.*

$52{\cdot}756\times 100=527{\cdot}56\times 10=5275{\cdot}6$ *Ans.*

To multiply a decimal by 100 we move the decimal point 2 *places* to the right.

So to multiply a decimal by 1000 we move the decimal point 3 *places* to the right.

$\therefore\ 5{\cdot}26\times1000=52{\cdot}6\times100=526\times10=5260$ *Ans.*

$\therefore\ 0{\cdot}7503\times1000=7{\cdot}503\times100=75{\cdot}03\times10=750{\cdot}3$ *Ans.*

$\therefore\ 3{\cdot}2\times1000=32\times100=320\times10=3200$ *Ans.*

## EXERCISES 27

Write down the values of the following :—

(1) $2{\cdot}5\times10$; $0{\cdot}25\times10$; $0{\cdot}025\times10$; $70{\cdot}5\times10$; $7{\cdot}05\times10$; $0{\cdot}03\times10$; $0{\cdot}004\times10$; $0{\cdot}0005\times10$; $0{\cdot}105\times10$;

(2) $3{\cdot}25\times100$; $2{\cdot}05\times100$; $32{\cdot}05\times100$; $3{\cdot}205\times100$; $0{\cdot}235\times100$; $0{\cdot}923\times100$; $0{\cdot}05\times100$; $231{\cdot}5\times100$;

(3) $1{\cdot}111\times1000$; $1{\cdot}205\times1000$; $3{\cdot}95\times1000$; $0{\cdot}3196\times1000$; $0{\cdot}3015\times1000$; ${\cdot}0031\times1000$; $0{\cdot}0004\times1000$; $0{\cdot}0415\times100$;

## DIVISION OF DECIMALS BY POWERS OF 10

5 units $\div10=$ 5 tenths $\therefore\ 5\div10=\frac{5}{10}=0{\cdot}5$ *Ans.*

5 tenths $\div10=$ 5 hundredths $\therefore\ 0{\cdot}5\div10=0{\cdot}05$ *Ans.*

To divide a decimal by 10 move the decimal point ONE place to the LEFT.

5 units $\div100$ is the same as dividing TWICE by 10 $(100=10\times10)$

5 units $\div100=0{\cdot}5\div10=0{\cdot}05$ *Ans.*

$0{\cdot}4\div100=0{\cdot}04\div10=0{\cdot}004$ *Ans.*

$23{\cdot}75\div100=2{\cdot}375\div10={\cdot}2375$ *Ans.*

To divide a decimal by 100, move the decimal point TWO places to the LEFT.

So to divide a decimal by 1000 move the decimal point THREE places to the LEFT $(1000=100\times10)$.

$258{\cdot}7\div1000=25{\cdot}87\div100=2{\cdot}587\div10=0{\cdot}2587$ *Ans.*

$3{\cdot}235\div1000=0{\cdot}3235\div100=0{\cdot}03235\div10=0{\cdot}003235$ *Ans.*

## EXERCISES 28

Write down the values of the following :—

(1) $27 \div 10$; $2{\cdot}7 \div 10$; $0{\cdot}27 \div 10$; $1{\cdot}25 \div 10$; $230 \div 10$; $230{\cdot}5 \div 10$; $3712 \div 10$; $2306 \div 10$; $2804 \div 10$; $2160 \div 10$;

(2) $323 \div 100$; $32{\cdot}3 \div 100$; $3{\cdot}23 \div 100$; $0{\cdot}323 \div 100$; $2105 \div 100$; $2405 \div 100$; $12{\cdot}33 \div 100$; $1{\cdot}212 \div 100$.

Express ·34 as a fraction

$$\cdot 34 = \tfrac{34}{100} = \tfrac{17}{50}$$
$$\cdot 035 = \tfrac{35}{1000} = \tfrac{7}{200}$$

Express the following decimals as fractions in the lowest terms.

(1) 0·5 (2) 0·7 (3) 0·9 (4) 0·2
(5) 0·6 (6) 0·35 (7) 0·16 (8) 0·28
(9) 0·32 (10) 0·96 (11) 0·125 (12) 0·375
(13) 0·725 (14) 0·02 (15) 0·07 (16) 0·205
(17) 0·025 (18) 0·003 (19) 0·102 (20) 0·256

Express in metres

(21) 2·4 Km. (22) 3·5 Km. (23) 2·12 Km. (24) 3·84 Km.
(25) 4·98 Km.

Express in kilometres.

(26) 2567 m. (27) 359 m. (28) 48 m. (29) 7 m.
(30) 18 m.

## ADDITION AND SUBTRACTION

Add together.

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| 73·15 | 86·5 | 241·2 | 219·56 |
| 63·19 | 86·05 | 325·04 | 23·03 |
| 34·1 | 80·3 | 319·63 | 129·56 |
| 82·6 | 79·04 | 101·8 | 34·78 |

| (5) | (6) |
|---|---|
| 0·043 | 0·107 |
| 2·105 | 0·76 |
| 7·085 | 2·391 |
| 6·23 | 10·056 |

(7) 3·5; 209; 8·75; 5·23
(8) 12·32; 30·05; 6·209; 0·819
(9) 0.0376; 0·9065; ·0071
(10) 1·035; 7·2; 5·006; 9·9084

Add together and give your answer in metres.

(11) 2 m. 5 dm. 6 cm. 8 mm.; 3 m. 4 cm. 9 mm.; 5 m. 6 dm. 6 mm.

(12) 3 m. 4 cm. 5 mm; 4 m. 9 cm. 8 mm; 6 m. 7 dm. 3 cm.

(13) 4 m. 6 dm. 9 cm; 5 m. 9 dm. 7 cm. 2 mm; 1 m. 7 cm. 2 mm.

## FURTHER EXERCISES

Find the value of :—

(1) 20·5 Km.−15·29 Km.
(2) 50·15 Km.−32·07 Km.
(3) 42·25m.−39·39 m.
(4) 20·02 m.−12·79 m.
(5) 5·8−2·05
(6) 3·81−1.89
(7) 7·6−2·38
(8) 8·4−2·075
(9) 1−0·397
(10) 0·924−0·07
(11) 7·3−1·5+2·9−0·7
(12) 5−0·4−0·25
(13) 10−0·06−0·07+0·02
(14) 1·02−0·2−0·002+7
(15) 2·05−0·5−0·005+6.

## DECIMALS : MULTIPLICATION AND DIVISION

*Example* (*i*) Multiply 2·49 metres by 8

2·49 metres
×8

19·92 metres

*Ans.* 19·92 metres (Read nineteen point nine, two)

*Example* (*ii*) 0·004553×4.

0·00453
4

0·01812 *Ans.*

*Example* (*iii*) Divide 35·76 by 6.

5·96 *Ans.*
6)35·76

## EXERCISES 29

1. (*a*) 73·86 ×4; ×7; ×6
   (*b*) 835·06 ×5; ×6; ×2
   (*c*) 800·07 ×5; ×6; ×3
   (*d*) 7073·62 ×9; ×8; ×7
   (*e*) 7080·05 ×3; ×7; ×5
   (*f*) 832·5 ×5; ×7; ×6
   (*g*) 8060·05 ×6; ×9; ×8

2. (*a*) 72·06 ÷6; ÷4; ÷3
   (*b*) 892·2 ÷5; ÷3; ÷2
   (*c*) 6·3 ÷7; ÷5; ÷9
   (*d*) 16·2 ÷9; ÷2; ÷4
   (*e*) 32·4 ÷9; ÷5; ÷6
   (*f*) 30·3 ÷6; ÷5; ÷2
   (*g*) 330·3 ÷6; ÷9; ÷2
   (*h*) 262·8 ÷8; ÷9; ÷4
   (*i*) 210 ÷8; ÷3; ÷7
   (*j*) ·08 ÷4; ÷2; ÷8

### *Conversion of fractions to decimals*

$\frac{4}{5}$, $\frac{1}{2}$, $\frac{3}{8}$ etc. are called vulgar fractions.
0·7; 0·83; 0·612 etc. are called decimal fractions.

*Example.* Express $\frac{3}{8}$ as a decimal fraction.

$$\begin{array}{r} 8\overline{)3\cdot000} \\ \hline 0\cdot375 \end{array}$$

8 will not go into 3. Put in the decimal point and add a zero. 8 goes 3 times into 30 with 6 over. Add another 0, 8 goes 7 times into 60 with 4 over. Add another 0, 8 goes 5 times into 40.

*Ans.* 0·375

## EXERCISES 30

Express as decimal fractions.

(1) $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$;
(2) $\frac{1}{5}$; $\frac{3}{5}$; $\frac{4}{5}$;
(3) $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$;
(4) $\frac{2}{5}$, $\frac{6}{8}$, $\frac{4}{16}$;
(5) $\frac{11}{10}$, $\frac{9}{4}$, $\frac{13}{8}$;
(6) $\frac{7}{2}$, $\frac{9}{5}$, $\frac{11}{8}$;
(7) $\frac{23}{8}$, $\frac{23}{4}$, $\frac{19}{8}$;
(8) $\frac{31}{5}$, $\frac{41}{8}$, $\frac{19}{4}$;
(9) $3\frac{3}{5}$, $4\frac{1}{8}$, $5\frac{1}{2}$;
(10) $2\frac{3}{4}$, $3\frac{1}{8}$, $7\frac{3}{5}$;
(11) $9\frac{1}{4}$, $4\frac{3}{5}$, $5\frac{5}{8}$;
(12) $8\frac{3}{8}$, $2\frac{5}{8}$, $4\frac{3}{4}$.

## Miscellaneous Decimals

(1) The perimeter of a triangle is 19 cm. If two sides measure 5·23 cm. and 6·15 cm., find the length of the third side.

(2) A boy's stride is 31·23 cm. How far will he cover in 9 strides ?

(3) Divide Rs. 28·96 equally among 8 boys.

(4) Express in Kilograms : 5129 gm., 7256 gm., 234 gm., 19 gm.

(5) Express in litres : 254 cl; 725 cl; 48 cl; 79 cl.

(6) Find the value of :—

(*a*) 75·23÷10; 75·46÷20; 84·06÷30; 89·48÷40.
(*b*) 10·24÷16; 48·72÷12; 67·51÷70; 67·51÷700.
(*c*) 76·5÷9; 76·5÷90; 76·5÷900; 8·37÷800.
(*d*) 65÷5; 6·5÷5; 0·65÷5; 0·065÷5.
(*e*) 762÷6; 76·2÷60; 7·62÷60; 0.762÷60.
(*f*) 35·2÷8; 3·52÷80; 0·352÷80; 0·0352÷80.

(7) Find the value of :—

(*a*) 2·6×8; 0·26×80; 0·026×80; 0·26×800.
(*b*) 4·25×5; 4·25×50; 0·0425×50; 0·425×500.
(*c*) 7·16×9; 0·716×12; 0·0213×13; 0·319×11.
(*d*) 0·001×11; 0·002×13; 0·002×112; 0·002×325.
(*e*) 2·03×8; 2·03×18; 2·03×180; 0·203×180.

(8) A train travels at the rate of 72·4 Km. per hour. How far will it travel in 12 hours ?

(9) A tin of sweets weighs 3·54 kg. Find the weight of 9 tins. Give your answer (a) in kilograms & (b) grams.

(10) A car travels 100 metres in 7·45 sec. How long will it take at the same rate to do (*a*) 1 kilometre & (*b*) 5 kilometres ?

(11) A wooden box contains 12 packets, each weighing 4·24 kg. If the box and the packets together weigh 52·31 kg. find the weight of the box.

(12) If one metre is equal to 39·37 inches, how many inches are there in (*a*) 10 metres & (*b*) 12 metres ?

(13) A metre of copper wire costs Rs. 1·27. Find the cost of 24 metres.

(14) A barrel contains 22 kg. of milk powder. If I give 15 children each 0·84 grams of powder, how much milk powder remains ?

(15) A metre of cloth costs Rs. 9. Find the cost of 15·75 metres.

## METRIC SYSTEM.

WEIGHT. The Unit of Weight is the gram (gm).
CAPACITY. The unit of capacity is the litre(1).

10 milligrams (mg) = 1 centigram (cg)
10 centigrams = 1 decigram (dg)
10 decigrams = 1 gram (gm)
10 grams = 1 Dekagram (Dg)
10 Dekagrams = 1 Hectogram (Hg)
10 Hectograms = 1 Kilogram (Kg)
100 centilitres (cl) = 1 litre

*Example* (*i*) Express 7456 mg. in gm., dg., cg., and mg.

10 | 7456 mg
10 | 745 cg 6 mg
10 | 74 dg 5 cg
7 gm 4 dg.

*Ans.* 7 gm. 4 dg. 5 cg. 6 mg.

*Example* (*ii*) Express 3024 mg. in gm., dg., cg. and mg.

10 | 3024 mg.
10 | 302 cg. 4 mg.
10 | 30 dg. 2 cg.
3 gm.

*Ans.* 3 gm. 2 cg. 4 mg.

## EXERCISES 31

Express in centigrams.

(1) 5 gm. 25 cg., 4 gm. 8 dg.; 17 gm. 3 dg. 4 cg.; 2 Dg. 3 gm; 4 Dg. 27 cg.

(2) Express in milligrams.
5 dg. 3 cg.; 5 Dg. 3 cg. 4 mg.; 4 dg. 4 cg. 4 mg.; 2 gm. 14 cg.; 4 gm.; 7 cg. 4 mg.

(3) Express in grams.
5 Kg., 5 Kg. 4 Hg., 4 Kg. 3 Hg. 7 Dg.; 3 Kg. 4 Hg. 6 Dg. 7 gm.

(4) Express in grams and milligrams.
3765 mg; 4657 mg.; 7095 cg.; 6005 mg.; 4105 gm.

(5) Express in Kg. and gm.
4785 gm.; 8765 gm.; 5014 gm.; 5005 gm.; 7006 gm.;

(6) Express in Kg., Hg., Dg. and gm.
4065 gm.; 7104 gm.; 8004 gm.; 7684 Dg.; 6105 Hg.; 92156 gm.; 321904 gm.; 30004 gm.

(7) A flask weighs 42.53 gm. when empty and 124.29 gm. when filled with water. Find the weight of the water.

(8) Subtract 2370 gm. from 4 Kg. Answer in Kg.

(9) Subtract 1465 m. from 2 Km. Answer in Km.

(10) Three parcels weigh 2 Kg. 126 gm.,; 3 Kg. 874 gm. 2 Kg. 624 gm. respectively. Find the total weight in Kg.

(11) How many pieces of tape each 12 cm. long can be cut from a tape of length 2 metres, and how much remains?

(12) A litre of petrol weighs 0·8 Kg. Find the total weight in Kg. of 3 litres of petrol are put into a tin which weighs 360 gm. when empty.

(13) A man walks 8 Km. in 75 minutes. How far does he walk in 1 hour ?

(14) A vessel contains 50 Kg. of jam. If jars were each filled with 1·75 Kg. of jam, how many jars will be needed ? How much remains ?

(15) A sheet of paper is 0·36 mm. thick. Find the height of a pile containing 150 sheets.

## UNITARY METHOD

*Example* (*i*) 77 bags can hold 4543 kg. of cement. How many Kg. can 49 bags hold ?

77 bags hold 4543 Kg.

1 bag holds $\frac{4543}{77}$ Kg.

49 bags hold $\frac{\overset{413}{\cancel{4543}}}{\underset{11}{\cancel{77}}}\times\overset{7}{\cancel{49}} = 413\times 7$ Kg.

$=2891$ Kg. *Ans.*

*Example* (*ii*) 96 articles cost Rs. 672. Find the cost of 64 articles.

96 articles cost Rs. 672

$\therefore$ 64 articles cost Rs. $\frac{\overset{112}{\cancel{672}}}{\underset{6}{\cancel{96}}}\times\overset{4}{\cancel{64}}$ (The middle-line statement has been omitted)

$=$Rs. $112\times 4$

$=$Rs. 448 *Ans.*

*Example* (*iii*) 24 men plough a field in 15 days. How long will 36 men take ?

24 men plough the field in 15 days.

36 men plough the field in $\frac{\overset{5}{\cancel{15}}\times\overset{2}{\cancel{24}}}{\underset{3}{\cancel{36}}}$

$=10$ days *Ans.*

### EXERCISES 32

Use the middle-line statement for Nos. 1-8.

(1) 39 pipe lengths extend to 429 inches. How far will (a) 88 pipes and (b) 46 pipes extend ?

(2) 49 bicycles cost Rs. 3087. What will (a) 23 bicycles & (b) 63 bicycles cost ?

(3) A sum of money was divided equally among 108 men. 63 of them received altogether Rs. 4375. What was the sum of money ?

(4) 75 packets of envelopes cost Rs. 60, find the cost of (i) 50 packets & (ii) 120 packets.

(5) 15 men weed a field in 28 days. How long will (a) 35 men or (b) 12 men take to do it ?

(6) 6 men do a piece of work in 14 days. How long will 21 men take to do the same work ?

(7) 30 men do a piece of work in 16 days, in what time should 12 men do it ?

(8) A train travelling at 75 Km. an hour completes a certain distance in 12 hours. How long will it take to do the same distance at 60 Km. an hour ?

Omit the middle-line statement in these problems :

(9) If the railway fare for 40 miles is Rs. 3, find the fare for 124 miles.

(10) 96 articles can be bought for Rs. 672. Find the cost of (a) 64 articles (b) 127 articles.

(11) A bookshelf holds 500 books, if each book is 3 cm. wide. How many will it hold if each book is 2 cm. wide ?

(12) A dozen bottles of pine apple juice costs Rs. 15. How many bottles can be obtained for Rs. 55 ?

(13) A cyclist riding at 10 Km. an hour takes $5\frac{1}{2}$ hours to complete a journey. How long would he have taken if he travelled at 11 Km. an hour ?

(14) A large tank is filled by 6 equal pumps in 9 hours. How long would it take if 2 pumps were out of order?

(15) A trench is dug by 8 men in 15 days. How long would 12 men take to do so ?

(16) Six men can address a pile of envelopes in 8 hours. How many men are required to address them in 3 hours ?

(17) The railfare for a journey of 680 Km. is Rs. 12. What would it be for 850 Km. ?

(18) A score of eggs costs Rs. 3. Find how many can be bought for Rs. 27.

(19) I buy an article for Rs. 15 and make a profit of Rs. 3 by selling it. What should I have gained at the same rate if the article had cost Rs. 100 ?

(20) There is sufficient food in a military camp to last 450 men for 24 days. How long will the food last for 750 men ?

## SHOPPING

Make out bills for the following :

(1) 6 boxes of matches at 76 nP. a dozen.
2 litres milk at 90 nP. a litre
2½ Kg. potatoes at 62 nP. a Kg.
4½ Kg. rice at Rs. 20 a Kg.

(2) 2½ Kg. mutton at Rs. 3·50 a Kg.
3 Kg. dhal at Re. 0·75 a Kg.
2½ Kg. ghee at Rs. 7·50 a Kg.
1½ Kg. coffee at Rs. 7 a Kg.

(3) ½ Kg. butter at Rs. 6·80 a Kg.
¼ Kg. spices at Rs. 8·20 a Kg.
2 chickens at Rs. 4·50 each.
¾ Kg. marmalade at Rs. 3·60 a Kg.

(4) 2½ dozen candles at Rs. 1·70 a dozen.
8 loaves at Rs. 0·75 a loaf.
500 gm. of cocoa at Rs. 7·40 a Kg.
250 gm. of margarine at Rs. 6·40 a Kg.

(5) 2 bottles ink at Rs. 1·30 a bottle.
3 dozen pencils at Rs. 4·25 a dozen.
2½ Kg. sweets at Rs. 3·62 a Kg.
3¼ Kg. toffee at Rs. 1·32 for 500 gm.

(6) 3¼ metres of silk at Rs. 3·46 a metre.
1¾ metres of tweed at Rs. 16·76 a metre.
2½ metres of ribbon at Rs. 1·60 a metre.
3 metres elastic at Re. 0·62 a metre.
What change will be left out of Rs. 50 ?

(7) 15 metres longcloth at Rs. 2·75 a metre.
24 metres curtain material at Rs. 3·20 a metre.
11 metres sheeting at Rs. 2·36 a metre.
10 metres flannel at Rs. 12·22 a metre.
What change will be left out of Rs. 350 ?

(8) 11 metres poplin at Rs. 2·62 a metre.
9 metres curtain material at Rs. 2·40 a metre.
7 shirts at Rs. 6.72 each.
5 pair of socks at Rs. 4·25 a pair.
What change will be left out of Rs. 127 ?

(9) 13 metres ribbon at Re. 0·95 a metre.
$16\frac{1}{2}$ metres elastic at Re. 0·78 a metre.
200 buttons at Rs. 1·25 a score.
216 rubbers at Rs. 17·28 a gross.

(10) 500 gm. tobacco at Rs. 4·15 per 100 gm.
$2\frac{1}{2}$ Kg. sugar at Rs. 2·12 a Kg.
$3\frac{1}{8}$ Kg. wheat at Re. 0·64 a Kg.
66 oranges at Rs. 2·62 a dozen.

## AVERAGES

If a man spends Rs. 70 in a week, then we can say that his *average daily spending* is Rs. $70 \div 7$ that is Rs. 10. This does not mean that he actually spends Rs. 10 each day, but that his total spending each week is the same as if he spent Rs. 10 every day.

A train does 240 miles in 8 hours so its *average speed* is $240 \div 8$ that is 30 miles *per hour*. This does not mean the train actually does 30 miles in every hour, but that the time taken is the same as if the train did 30 miles every hour.

*Example*

A cricketer scores 17, 34, 12, 21, 46 runs respectively in 5 innings, being out each time. Find his average score

He scores $17+34+12+21+46$ runs in 5 innings.

∴ His Total score is 130 runs,
The number of innings is 5.

∴ His average score is $\frac{130}{5}=26$ runs.

*Example* (*ii*)

John's marks in English in 6 tests are 45, 56, 64, 31, 40 and 46. Find his average marks.

John's total marks $=45+56+64+31+40+46=282$

Number of tests $=6$

$\therefore$ His average marks are $282\div 6=47$ $\quad \begin{array}{r}47\\ 6\overline{)\underline{282}}\\ 42\end{array}$

*Ans.* 47 marks.

So we can make a rule for finding averages.

$$\text{Average}=\frac{\text{Total of quantities.}}{\text{Number of quantities.}}$$

## EXERCISES 33

(1) Find the average height of a hockey team, members of which are: 1·70 m., 1·73 m., 1·80 m., 1·85 m., 1.68 m., 1·75m., 1·70 m., 1·82 m., 1·92 m., 1·62 m. tall respectively.

(2) The rainfall of a certain place is as follows :—

| 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 |
|---|---|---|---|---|---|---|
| 250 cm | 238 cm | 275 cm | 300 cm | 242 cm | 251 cm | 229 cm |

Find the average yearly rainfall.

(3) The weights of members of the crew of an eight-oared boat are as follows :—
79·2 Kg.; 85·1 Kg.; 85·2 Kg.; 90 Kg.; 97 Kg.; 100·4 Kg.; 101·1 Kg.; 91·6 Kg.
Find the average weight of the crew.

(4) The ages of seven boys in a class are as follows :—
12 yrs. 7 mths; 11 yrs. 9 mths.; 11 yrs. 11 mths.; 12 yrs. 2 mths.; 12 yrs. 4 mths.; 12 yrs. 11 mths.; 12 yrs. 8 mths. Find their average age.

(5) The average age of a class of 12 children is 11 yrs. 9 mths. A new boy joins the class and the average; now is 11 yrs. 8 mths. Find the age of the new boy.

(6) The average monthly rainfall of a certain town is 43 mm. If the total rainfall for January to May is 201 mm, what is total rainfall for the other 7 months? What is the average monthly rainfall for these 7 months?

(7) Two classes containing 20 and 25 pupils sit for an examination. The average marks for these classes are 60 and 51 respectively. Find the average marks of all the pupils in both classes.

(8) I buy 2 shirts at Rs. 12·50 each, 5 shirts at Rs. 12 each and 3 shirts at Rs. 11·50 each. Find the average price of each shirt.

(9) A train does the first 500 Km. of journey in 6 hours and the next 850 Km in 9 hours. Find its average speed per hour.

(10) A boy's average marks in an examination were 58. He obtained 49 in English; 64 in Mathematics; 52 in Geography; 45 in Hindi; 59 in History, but forgot his marks in Science. How much did he get in Science?

(11) John, Robert and Harold sit for an examination and their marks are as follows :—

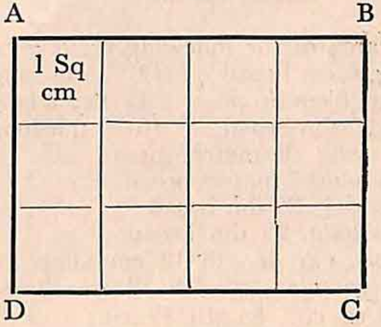
John takes six subjects and his marks are 48, 64, 75, 34, 63, 70.

Robert takes seven subjects and his marks are 52, 45, 48, 61, 25, 50, 71.

Harold takes eight subjects and his marks are 64, 72, 65, 46, 51, 53, 54, 35.

Find the total marks of each boy. Find the average marks of each boy. Who has done the best in the examination?

## AREA



ABCD is a rectangle, 4 cm long, 3 cm broad. The figure is divided in squares of side 1 cm. So each square has an area of 1 sq. cm.

There are 12 squares. So the area of the rectangle ABCD is 12 sq. cm.

So the area can be obtained by the rule
"Multiply the length by the breadth".
Area = Length × Breadth sq. units.

OR

$A = L \times B$ sq. units.

This formula can be written in either of the following ways :—

$$L = A \div B = \frac{A}{B}$$

$$B = A \div L = \frac{A}{L}$$

So Length = Area ÷ Breadth
Breadth = Area ÷ Length

The *perimeter* of the above figure ABCD is the sum of its four sides i.e. $4 + 3 + 4 + 3 = 14$ cm.

## EXERCISES 34

Find the area of the following rectangles :

(1) 8 cm long, 6 cm broad (2) 7 cm long, 5 cm broad
(3) 11 cm long, 8 cm broad (4) 12 cm long, 15 cm broad
(5) 5 dm long, 7 dm broad (6) 9 dm long, 8 dm broad
(7) 8 metres long, 6 metres broad
(8) 12 metres long, 7 metres broad
(9) 15 metres long, 22 dm broad
(10) 18 metres long, 25 dm broad.
(11) Area 84 sq. cm; length 12 cm; find the breadth.
(12) Area 192 sq. cm; breadth 12 cm; find the length.
(13) Area 289 sq cm; length 17 cm; find the breadth.
(14) Area 256 sq m; length 32 m; find the breadth.
(15) Area $5\frac{1}{2}$ sq m; length $2\frac{1}{2}$ m; find the breadth.
(16) Area $3\frac{3}{4}$ sq m; breadth $1\frac{1}{2}$ m; find the length.
(17) The length of a room is $2\frac{1}{2}$ m; the breadth is $1\frac{3}{4}$ m; find the area.
(18) The width of a carpet is $1\frac{3}{4}$ m; the area is 6 sq. m; find the length.
(19) The length of a field is 120 metres, the perimeter 400 metres, find the area of the field.
(20) The perimeter of a rectangle is 2 metres, and its breadth 23 cm. Find its length and area.
(21) The perimeter of a square is 1 m 60 cm. Find the area of the square.
(22) The area of a rectangular field is 4840 sq. metres; it is 55 metres in width. Find its perimeter.

1 Square metre is the area of a square 1 metre long and 1 metre wide i.e. 100 cm long and 100 cm wide.

$$\therefore\ 1 \text{ sq. metre} = 1 \text{ metre} \times 1 \text{ metre}$$
$$= 100 \text{ cm.} \times 100 \text{ cm.}$$
$$= 10{,}000 \text{ sq. cm.}$$
$$\therefore\ 1 \text{ sq. metre} = 10{,}000 \text{ sq. cm. or } 10^4 \text{ sq. cm.}$$

*Learn these tables.*

100 sq mm = 1 sq centimetre
100 sq cm = 1 sq decimetre (dm)
100 sq dm = 1 sq metre (m)
100 sq m = 1 sq Decametre (Dm)
100 sq Dm = 1 sq Hectometre (Hm)
100 sq Hm = 1 sq Kilometre (Km)

## EXERCISES 35

(1) A rubber is 24 mm long and 2 cm wide. Find its area in (i) sq mm (ii) sq cm.

(2) A rectangular piece of cardboard is 3·5 cm long and 5 cm wide. ,Find its area in (i) sq mm and (ii) sq cm.

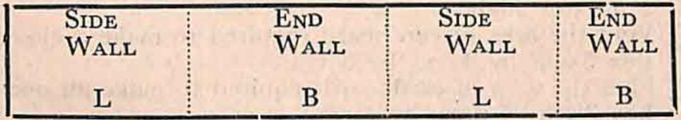
(3) A sheet of paper is 12·5 cm long and 11 cm wide. Find its area in (i) sq cm and (ii) sq mm.

(4) A rectangle is 25 dm long and 15 dm wide. Find its area in sq metres.

(5) A room is 28 sq m in area and the breadth is 4 metres. Find the length of the room in decimetres.

(6) The perimeter of a rectangular lawn in 4840 decimetres and breadth is 1200 dm. Find its area in sq metres.

*Area of the 4 walls of a room.*



Draw the rectangle shown above on a sheet of paper and fold it on the dotted line. You now have the 4 walls of a room.

To find the area of the four walls you must find the area of the large rectangle.

One side of this large rectangle is the height of the room. The other side is equal to two lengths and two breadths.

So the rule for finding the area of the four walls is then "Add the length and the breadth and multiply the sum by *two*: then multiply the answer by the height".

We can write this shortly :—

$$A = 2 \times (L + B) \times H$$

OR

$$A = 2H \times (L + B).$$

*Example.* Find the area of the walls of a room given that the length$=$6 metres, breadth$=$4 metres and height$=$3 metres

$$A = 2H \times (L + B)$$
$$= 2 \times 3 \times (6 + 4) = 2 \times 3 \times (10) = 6 \times 10$$
$$= 60 \text{ sq. m.}$$

## EXERCISES 36

Find the area of the walls of a room, given the following measurements. Give your answers in sq metres.

| | Length | Breadth | Height |
|---|---|---|---|
| (1) | 7 m | 5 m | 4 m |
| (2) | 8 m | 6 m | 5 m |
| (3) | $6\frac{1}{2}$ m | $4\frac{1}{2}$ m | 3 m |
| (4) | $9\frac{1}{4}$ m | $5\frac{3}{4}$ m | 4 m |
| (5) | $8\frac{1}{2}$ m | $4\frac{1}{2}$ m | $2\frac{1}{2}$ m |

(6) How many sq metres of wall paper will be required for a room 8 metres long, 5 metres wide and 4 metres high if we deduct 20 sq metres for doors and windows ?

(7) Find how many square metres of wall paper will be required for a square room o side $12\frac{1}{2}$ metres and 5 metres high.

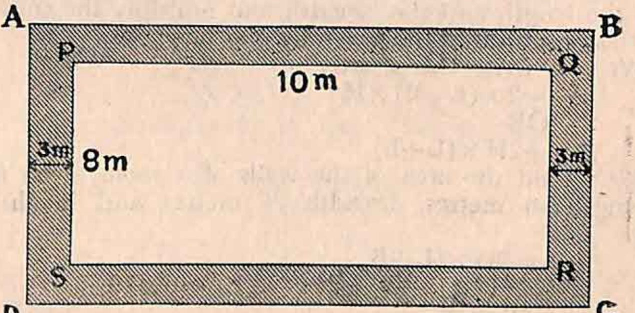
(8) Find the area of cardboard required to make a closed box 5 cm by 4 cm by 3 cm.

(9) Find the area of cardboard required to make an open box 7 cm by 6 cm by 4 cm.

(10) Find the area of metal sheeting needed to make a closed box 5·5 cm by 4·5. cm by 3 cm.

*Example.*

PQRS is a rectangular lawn surrounded by a gravel path. PQ=10 metres; RS=8 metres. The path is everywhere 3 metres wide. Find the area of the gravel path (shaded position).



Area of $PQRS = L \times B = 10 \times 8 = 80$ sq. m.
Length of $AB = 10 + 3 + 3 = 16$ m.
Length of $BC = 8 + 3 + 3 = 14$ m.
$\therefore$ Area of $ABCD = 16 \times 14 = 224$ sq metres.
$\therefore$ Area of gravel path = Area of ABCD − area of PQRS
$= 224 - 80$
$= 144$ sq metres.

It is much easier to use the "subtraction" method than to divide up the border into rectangles.

(Draw a diagram before working each problem)

(11) A rectangular lawn 15 m long 13 m wide is surrounded by a path $1\frac{1}{2}$ m wide. Find the area of the path.

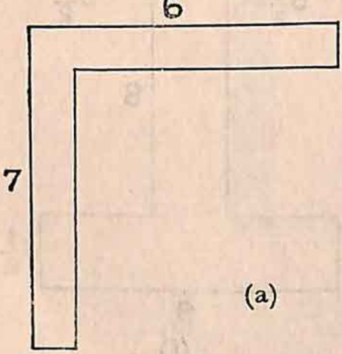
(12) The floor of a room is 8 m long and 6 metres wide. A border $\frac{1}{2}$ metre in width is painted all round the room. Find the area that is not painted.

(13) A carpet is placed in a room so as to leave a border $\frac{1}{2}$ m wide all round the room. If the room is 11 m long and 9 metres wide, find the area of the carpet.

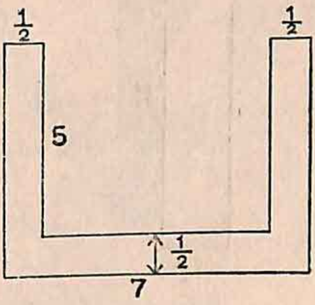
(14) A photograph 15 cm wide and 24 cm high is mounted on a card so that there is a margin $3\frac{1}{2}$ cm wide all round. Find the area of the card which is not covered.

(15) A picture frame is 27 cm long and 20 cm wide. The frame is $1\frac{1}{2}$ cm wide. Find the area of the picture space.

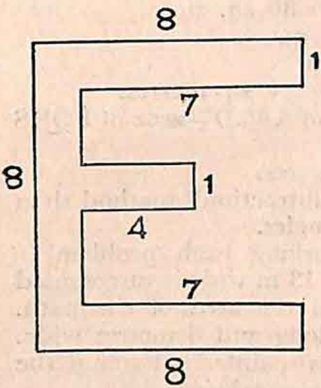
(16) Find the area of the following figures by dividing them into rectangles. All the corners are right angles and the measurements are in cm.



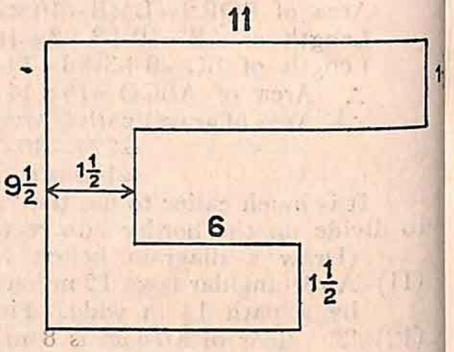
(a)



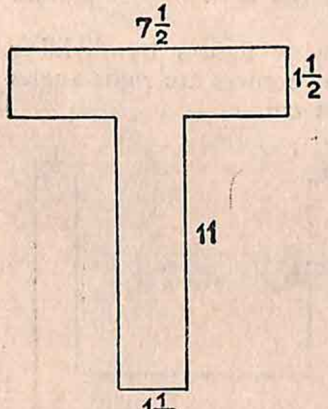
(b)



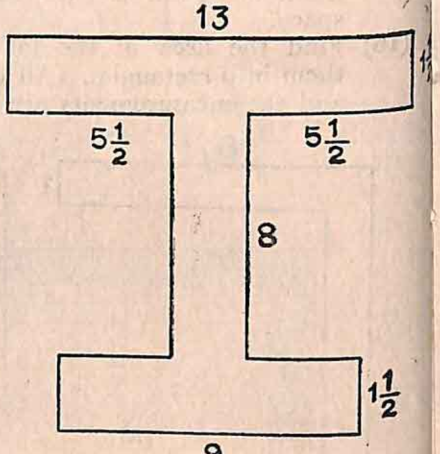
(c)


11
1
$9\frac{1}{2}$
$1\frac{1}{2}$
6
$1\frac{1}{2}$

(d)

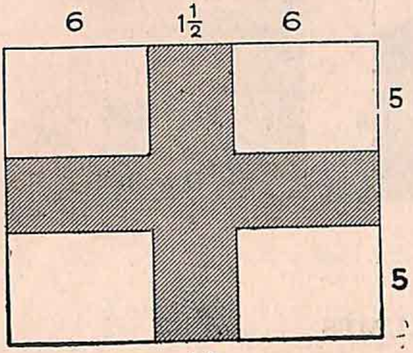

$7\frac{1}{2}$
$1\frac{1}{2}$
11
$1\frac{1}{2}$

(e)

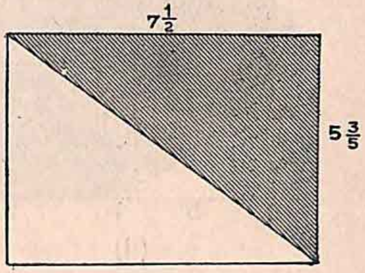

13
1
$5\frac{1}{2}$
$5\frac{1}{2}$
8
$1\frac{1}{2}$
9

(f)

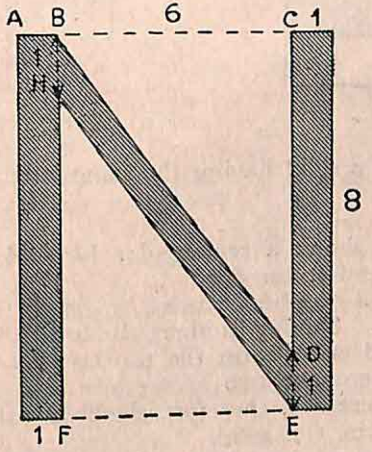
(17) Find the area of the shaded position in each of the following figures. All measurements are in cm. All corners are right angles.



(a)



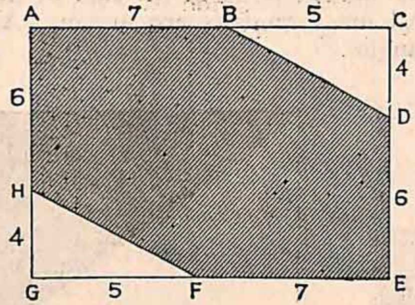
(b)



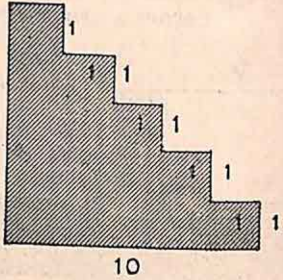
(c)

Hints for (c) above :

Find the areas of triangles BCD and FHE.
Find the area of BCEF.
Now find the area of BDEH.



(d)



(e)

## VOLUMES

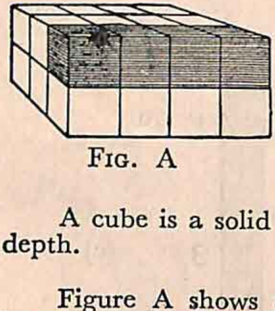


Fig. A

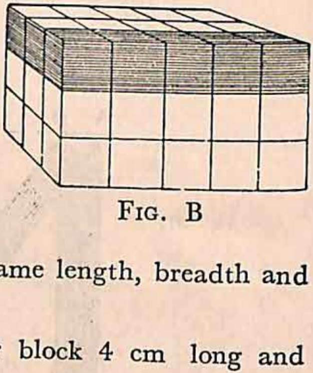


Fig. B

A cube is a solid having the same length, breadth and depth.

Figure A shows a rectangular block 4 cm long and 3 cm broad and 2 cm deep.

Notice that 4 cubes fit along the length;
3 cubes fit along the breadth;
So 4×3 cubes form the top layer.
There are two layers in the solid.
There are, therefore, 4×3×2 cubes in the solid i.e. 24 cubes in the solid.

The space occupied by a cube of side 1 cm is 1 cubic centimetre (in short c. c.)

So the space occupied by 24 cubes is 24 cubic centimetres or 24 cc.

Figure B shows a rectangular block 5 cm long, 3 cm broad and 3 cm deep.

There are 3 layers of cubic centimetres in the depth.

Each layer contains $5 \times 3$ cubic centimetres.

So the volume of the solid is $5 \times 3 \times 3$ cubic centimetres.

$= 45$ cubic centimetres

$= 45$ cc.

*Rule* : Volume $=$ length $\times$ breadth $\times$ depth.

$\therefore V = l \times b \times d.$

$\therefore V = lbd.$

## EXERCISES 37

(1) How many cubic-centimetre blocks are required to build up the following rectangular solids ?
(i) 4 cm by 5 cm by 6 cm.; (ii) 7 cm by 8 cm by 4cm.
(iii) 8 cm by 9 cm by 6 cm.

(2) How many cubic-centimetre blocks are required to build up the following cubes ?
(i) 2 cm cube (ii) 4 cm cube (iii) 8 cm cube (iv) 1 dm cube.

Find the volume of the following rectangular solids :

(3) 8 cm by 9 cm by 4 cm.

(4) 12 cm by 9 cm by 8 cm.

(5) 11 cm by 9 cm by 7 cm.

(6) 15 cm by 12 cm by 10 cm.

(7) Find the volume of room 9 m long, 7 m. wide, 5 m high.

(8) A steel tank is 5 m long, 4 m wide and 3 m. high. How many cubic metres of sand will it hold when it is (i) full, (ii) half full, (iii) quarter full ?

*Example.* The volume of a rectangular solid is 240 cc. If it is 10 cm. long and 4 cm wide, find its height.

$$
\begin{aligned}
V &= l \times b \times h \\
&= \text{area} \times h \\
h &= V \div \text{area} \quad \text{or} \quad V \div (l \times b) \\
h &= 240 \div (10 \times 4) \\
&= 240 \div 40 \\
\therefore h &= 6 \text{ cm } \textit{Answer}.
\end{aligned}
$$

### 4.

(1) Share Rs. 272 between A, B and C so that B has Rs. 12 more than C and A has Rs. 8 more than B.
(2) Three books weigh 0·25 Kg; 0·61 Kg; 0·709 Kg. Find the total weight in Kg.
(3) Multiply 35·27 by (i) 5; (ii) 10; (iii) 100.
(4) Find the prime factors of 3402.
(5) Find the H.C.F. of 72, 96.

### 5.

(1) Find the prime factors of (i) 7680 (ii) 2592.
(2) Find the H.C.F. of 34, 68, 85.
(3) Find the L.C.M. of 12, 15, 18.
(4) Write down the values of (a) $\frac{3}{5}$ of Rs. 3 (b) $\frac{7}{10}$ of 2 metres (d) $\frac{7}{12}$ of 1 hour.
(5) Simplify (i) $\frac{3}{4}+\frac{5}{6}+\frac{2}{3}$ (ii) $\frac{5}{12}+\frac{2}{3}-\frac{1}{4}$.

### 6.

(1) Find the prime factors of (i) 1584 (ii) 1430.
(2) Find the H.C.F. and L.C.M. of 24, 36, 48, 75.
(3) Simplify $2\frac{1}{3}+\frac{5}{12}+\frac{2}{3}\times1\frac{3}{5}$
(4) If $\frac{4}{7}$ of a certain sum of money is Rs. 56, what is half of it ?

### 7

(1) Using prime factors find the L.C.M. and H.C.F. of 10, 24, 108.
(2) Add together $\frac{3}{8}$ of Rs. 4, $\frac{5}{6}$ of Rs. 1·80 and $\frac{7}{12}$ of Rs. 2·88
(3) Simplify (i) $\frac{3}{7}\times2\frac{2}{3}\times1\frac{3}{4}$ (ii) $2\frac{2}{9}\div4\frac{2}{5}$.
(4) Divide (i) 6·4 by 20 (ii).9.2 by 4 (iii) 3·12 by 100.
(5) The length of a tape is 20 metres. 200 pieces each 7·5 cm long are cut off. Find the length of the remaining piece.

## 8.

(1) Add $2{\cdot}75+4{\cdot}21+3{\cdot}15+0{\cdot}02$.
(2) Subtract (a) 4·97 from 7·19 (b) 3·01 from 5·2.
(3) Express as a fraction (i) 0·6; (ii) 0·24; (iii) 0·75; (iv) 0·125.
(4) Express as decimals (i) $\frac{3}{5}$; (ii) $\frac{5}{8}$; (iii) $\frac{9}{5}$; (iv) $4\frac{3}{8}$.
(5) Find the value of (i) $2{\cdot}7\times8$; (ii) $0{\cdot}125\times6$; (iii) $3{\cdot}52\div8$.

## 9.

(1) Two sides of a triangle measure 7·15 cm and 6·81 cm. Ifthe perimeter of the triangle is 21·87 cm, find the length of the third side.
(2) Simplify $(3\frac{1}{4}-2\frac{3}{8})\div3\frac{1}{2}$.
(3) Express 55 minutes as a fraction of an hour.
(4) A car travels 3696 metres in 3 minutes. How far does it travel in a minute ? How many metres will it cover in 5 minutes ?
(5) 15 books cost Rs. 42. Find the cost of 35 books.

## 10.

(1) A number multiplied by $\frac{7}{8}$ gives 42. What is the number ?
(2) If 32 men have food to last them 18 days, how long will the food last them if there are 48 men ?
(3) Simplify (i) $\frac{1}{2}-\frac{1}{3}+2\frac{2}{4}-\frac{1}{9}$ (ii) $\frac{14}{15}\div\frac{7}{9}+\frac{10}{21}$.
(4) Find the total cost of 7 metres of ribbon at Rs. 1·50 a metre, 5 Kg sugar at Rs. 2·12 a Kg, $1\frac{1}{2}$ score eggs at Rs. 3·20 a score.
(5) Find the average of the following marks :
25, 32, 67, 83, 48.

## 11.

(1) Express in Kg. : 4251 gm; 789 gm; 78 gm.
(2) The length of a room is 12 metres and its breadth is 7·5 metres. Find the area and perimeter of the floor of the room.
(3) The room is 6 metres long, 5 metres wide and 4 metres high. Find the area of the four walls.
(4) Find the volume of a box 25 cm by 15 cm by 11 cm.
(5) A man earns Rs. 225 in 35 days. How much will he earn in 42 days ?

9) The volume of a rectangular solid is 480 cc.
   (i) Find its height if its length is 15 cm and breadth is 8 cm.
   (ii) Find its length if its height is 10 cm and breadth is 6 cm.
   (iii) Find its height if the area is 96 sq. cm.

(10) The volume of a rectangular solid is 760 cm.
   (i) Find its height if the base has an area of 190 sq cm.
   (ii) Find its length if the height is 19 cm and breadth is 4 cm.
   (iii) Find its breadth if the length is 10 cm and height is $9\frac{1}{2}$ cm.

### *Capacity*

The unit of capacity is 1 litre (1). This is used for measuring volumes of liquids.

Volume

$1000(=10^3)$ cu. mm =1 cu. cm.
1000 cu. cm =1 cu. dm.
1 litre =1 cubic decimetre (cu. dm)
=1000 cu. cm
$\frac{1}{10}$ litre =1 decilitre (dl)
$\frac{1}{100}$ litre =1 centilitre (cl)
$\frac{1}{1000}$ litre =1 millilitre (ml)

1 cu cm is usually written as 1 cc.
1 cc of water weighs 1 gm.
1000 cc of water weighs 1 Kg (1000 gm)
So 1 litre of water weighs 1 Kg.

## EXERCISES 38

(1) Express in cc :—2 cu dm; 3 cu dm; 1·5 cu dm; 2·5 cu dm; 0.8 cu dm; 0·75 cu dm; 0·25 cu dm; 1 litre; 5 litres; 11 litres; 0·35 litre; 0·2 litre; 0·02 litre; 0·002 litre.

(2) Express in cu dm :—2000 cc; 1500 cc; 750 cc; 500 cc; 275 cc; 55 cc; 25 cc; 5 cc; 8 cc; 1 litre; 2·5 litres; 24 litres; 0·4 litre; 0·8 litre; 0·08 litre; 0·045 litre; 0·004 litre.

(3) What is the weight of (i) 5 cc of water; 27 cc of water; 250 cc. of water; 5 cu dm of water; 4 litres of water ?

(4) The internal measurements of a rectangular can are 12 cm by 8 cm by 4 cm. Express its capacity in litres and find the weight in gm of the water it will hold.

(5) A wooden box 72 cm by 30 cm by 25 cm is filled with packets of biscuits. Each packet is 8 cm by 6 cm by 5 cm. Find the number of packets in the box.

## REVISION EXAMPLES

### 1.

(1) What number multiplied by 13 gives 4251 ?
(2) Add: 86145; 59864; 60708; 478.
(3) Find the cost of 34 books at Rs. 13·55 each ?
(4) Express 231 in prime factors.
(5) Multiply 73·86 by 7.

### 2.

(1) What number when divided by 17 gives 309 ?
(2) Subtract 59816 from 72309.
(3) A school contains 584 pupils. If there are 28 more boys than girls, find the number of girls.
(4) The cost of 27 books is Rs. 255·69. Find the cost of each.
(5) Divide 178·83 by 9.

### 3.

(1) Add 0·82; 1·64; 3·59.
(2) In a train there are 1425 passengers. There are 120 in the first class; 215 in the 2nd; how many are travelling in third class ?
(3) Subtract 1·071 from 3·51.
(4) What must be added to $1\frac{2}{3}$ to make $2\frac{1}{6}$?
(5) Express 3 Kg 25 gm in (a) gm (b) Kg.

## 12.

(1) A tank is 5 dm long, 2 dm wide, and 2 dm high. How many litres of water will the tank hold ?

(2) A picture is mounted on a cardboard 25 cm long and 14 cm wide leaving a margin 3 cm wide all round. Find the area of the picture.

(3) $\frac{2}{5}$ of John's pocket money is equal to $\frac{2}{7}$ of Peter's. If Peter has Rs. 42, how much has John ?

(4) The average weight of 8 boys in a class is 50·25 Kg., and of 9 boys 50 Kg. Find the weight of the ninth boy.

(5) A car can go 76·2 Km on 12 litres of petrol. How far will it go on 32 litres ?

## PERCENTAGES

*Example* (i) A boy obtained 28 marks out of a maximum of 80 in a geography test. What should his marks be out of 100 ?

We work this sum by using the "unitary method".

When the maximum is 80, the marks are 28.

∴ When the maximum is 100, the marks are $\frac{\overset{7}{\cancel{28}}}{\underset{\cancel{20}}{\cancel{80}}} \times \overset{5}{\cancel{100}}$

$=35$

When the maximum is 100, the marks are called percentage marks.

"Per cent" means "out of 100". "Per cent" in short is written as %.

*Example* (ii) A boy obtained 90 marks out of a maximum of 150 in a science examination. Find his marks as a percentage.

When the maximum is 150, the marks are 90.

∴ When the maximum is 100, the marks are $\frac{\overset{30}{\cancel{90}}}{\underset{50}{\cancel{150}}} \times \overset{2}{\cancel{100}}$

$=60$

*Ans.* 60%.

*Example* (iii) Express (a) $\frac{3}{4}$ as a percentage.
(b) 35% as a fraction.

(a) $\frac{3}{4}$ of $100 = \frac{3}{\cancel{4}} \times \cancel{100}\ 25 = 75\%$ *Ans.*

(b) 35% $\frac{\overset{7}{\cancel{35}}}{\underset{20}{\cancel{100}}} = \frac{7}{20}$ *Ans.*

## EXERCISES 39

(1) In a test in History the maximum marks were 60. John obtained 45, Peter 36, and Harry 42. Express their marks as a percentage.

(2) Find the percentage marks.

| | 1st boy | 2nd boy | 3rd boy |
|---|---|---|---|
| History (Max. 60) | 54 | 45 | 30 |
| Arithmetic (Max. 70) | 42 | 35 | 28 |
| English (Max. 150) | 99 | 84 | 75 |
| Dictation (Max. 40) | 32 | 24 | 22 |
| Science (Max. 75) | 63 | 60 | 54 |
| Geography (Max. 48) | 36 | 42 | 18 |

(3) A boy obtained $\frac{3}{4}$ of the maximum marks in a subject. What were his marks as a percentage ?

(4) A boy obtained 15 marks out of 45. What were his percentage marks ?

(5) In an examination a boy obtained 224 marks out of 400. What was his percentage ?

(6) A boy got 60% in English. If the maximum marks were 80, what were his actual marks ?

(7) A boy got 80 marks in a test and his percentage was 64. What were the maximum marks for the test ?

(8) What are full marks for a paper if a girl who gets 128 marks obtains 80% of the total ?

(9) In a school there are 300 children, 25% of them are girls. How many girls are there in the school ?

(10) A boy loses 50% of his pocket money. If his pocket money is Rs. 10 how much has he lost ?

(11) A boy spends 30 per cent of his money in the tuck-shop. If he got Rs. 5/- as pocket money, how much has he left ?.

(12) Father saves 10% of his monthly salary. If he earn Rs. 250, how much does he save ?

(13) 55 per cent of the pupils in a school are boys. What percentage of the pupils are girls ? Find the number of pupils if there are 270 girls.

Express the following as percentage :—

(14) $\frac{1}{2}$, $\frac{1}{5}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{8}$, $\frac{1}{12}$;
(15) $\frac{1}{20}$, $\frac{1}{50}$, $\frac{1}{40}$, $\frac{1}{25}$, $\frac{7}{40}$, $\frac{1}{30}$;
(16) $\frac{3}{5}$, $\frac{7}{5}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{5}{6}$;
(17) $\frac{8}{16}$, $\frac{8}{15}$, $\frac{13}{20}$, $\frac{13}{25}$, $\frac{9}{25}$, $\frac{37}{50}$.

Express the following percentages as fractions :—

(18) 5%, 10%, 20%.
(19) 15%, 45%, 85%.
(20) 2%, 4%, 150%.
(21) $2\frac{1}{2}$%, $6\frac{1}{4}$%, $12\frac{1}{2}$%.
(22) $18\frac{3}{4}$%, $7\frac{1}{2}$%, $37\frac{1}{2}$%.
(23) $33\frac{1}{3}$%, $66\frac{2}{3}$%, $8\frac{1}{3}$%.
(24) 200%, 250%, 275%.

*Example* (i). A bookseller buys a book for Rs. 8 and sells it for Rs. 10/-. What is his profit ? Find this profit as a percentage of his cost price.

| | |
|---|---|
| Selling price | Rs. 10. |
| Cost price | Rs. 8. |
| Gain | Rs. 2. |

$\therefore$ Percentage profit is $\dfrac{\text{gain}}{\text{cost price}}\times 100\%$

$$=\frac{\cancel{2}}{\underset{\cancel{4}}{\cancel{8}}}\times\overset{25}{\cancel{100}}\%$$

*Ans.* 25% gain.

The percentage gain can also be done as follows :—
When cost price is Rs. 8, gain is Rs. 2.

$\therefore$ When cost price is Rs. 100 gain is $\dfrac{\cancel{2}}{\underset{\cancel{4}}{\cancel{8}}}\times\overset{25}{\cancel{100}}$

$$=25$$

*Ans.* 25% gain.

*Example* (ii).

An article costing Rs. 12 is sold for Rs. 9. Find the actual loss. Find the loss per cent on his cost price.

Cost price = Rs. 12
Selling price = Rs. 9
Loss = Rs. 3

When cost price is Rs. 12 loss is Rs. 3

$\therefore$ when cost price is Rs. 100 loss is $\dfrac{\cancel{3}}{\underset{\cancel{4}}{\cancel{12}}}\times\overset{25}{\cancel{100}}$

$$=25$$

*Ans.* 25% loss.

When finding the gain on loss per cent you must always calculate it on the COST PRICE.

*Example* (iii) A dealer gained 40% by selling a book for Rs. 28. Find the cost price.

If the cost price is Rs. 100 the gain is Rs. 40. So the selling price is Rs. 140.

When selling price is Rs. 140, the cost price is Rs. 100.

∴ When selling price is Rs. 28, the cost price is

$$\text{Rs. } \frac{\overset{5}{\cancel{100}}}{\underset{7}{\cancel{140}}} \times \overset{4}{\cancel{28}} = \text{Rs. } 20$$

*Ans.* Rs. 20

## EXERCISES 40

Find the gain or loss per cent in the following :

(1) Cost price (C.P.) Rs. 50; gain Rs. 6.
(2) C. P. Rs. 25; gain Rs. 5.
(3) C. P. Rs. 60; gain Rs. 6.
(4) C. P. Rs. 80; gain Rs. 10.
(5) C. P. Rs. 70; loss Rs. 7.
(6) C. P. Rs. 120; loss Rs. 30.
(7) C. P. Rs. 150; loss Rs. 45.
(8) C. P. Rs. 240; loss Rs. 96.
(9) Selling price (S. P.) Rs. 10 & gain Rs. 2.
(10) S. P. Rs. 15; gain Rs. 3.
(11) S. P. Rs. 25; gain Rs. 3.
(12) S. P. Rs. 58; gain Rs. 8.
(13) S. P. Rs. 60; loss Rs. 20.
(14) S. P. Rs. 80; loss Rs. 40.
(15) S. P. Rs. 150; loss Rs. 10.
(16) C. P. Rs. 35; S. P. Rs. 42.
(17) C. P. Rs. 30; S. P. Rs. 42.
(18) C. P. Rs. 25; S. P. Rs. 15.
(19) C. P. Rs. 4·50; S. P. Rs. 6.
(20) C. P. Rs. 200; S. P. Rs. 230.
(21) A man bought a chair for Rs. 28 and sold it for Rs. 35. Find his gain per cent.
(22) A cycle was bought for Rs. 120 and sold at a gain of 25%. Find the selling price.

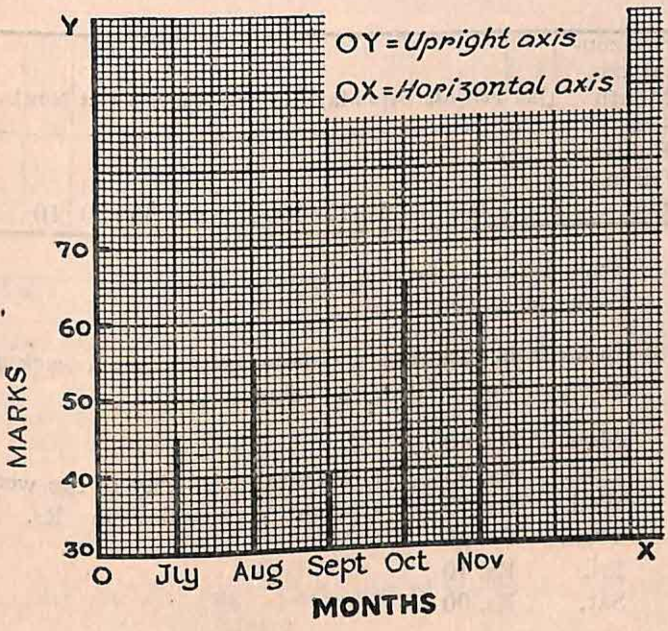
(23) A book was sold for Rs. 42 at a gain of 5%. Find the cost price.
(24) A radio is sold for Rs. 635 at a gain of 27%. Find the cost price and the actual gain.
(25) By selling my typewriter for Rs. 180 I shall lose 64%. What did I pay for it?
(26) By selling my camera for Rs. 189 I shall lose 16%. Find my buying price.

## COLUMN GRAPHS

The reason for representing certain facts by a graph is to give information rapidly or quickly.

*Example :*

John's marks for the monthly tests from July to November were 45, 55, 40, 65, 60 respectively. Show these marks on a column graph.



## EXERCISES 41

Use squared paper.

(1) Draw a column graph to show the average weight of boys of different ages :—

| Horizontal axis Age in years | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|
| Unright axis weight in Kg. | 25 | 28 | 31 | 34 | 37 |  | 44 | 48 |

What do you think is the average weight at age 12 ? Draw the column for age 12. Give the graph a title.

(2) Draw a column graph for the rainfall of a town in India with the amounts of rainfall shown below :

| Horizontal axis Month | Jan | Feb | Mar | Apr | May | Jun | July | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall in mm. | 5 | 0 | 0 | 5 | 15 | 100 | 250 | 90 | 55 | 30 | 10 |  |

Scale 1 small square=5 mm.
Give the graph a title.

(3) In a school tuck-shop the daily sales during a week are given below: Draw a column graph.

|  |  |
|---|---|
| Mon. | Rs. 40 |
| Tues. | Rs. 35 |
| Wed. | Rs. 75 |
| Thus. | Rs. 25 |
| Fri. | Rs. 10 |
| Sat. | Rs. 90 |

Horizontal axis—day of the week.
Upright axis—sales in Rs.

The children get their pocket money twice a week. Can you say from the graph which days they were ? Give a title for the graph.

(4) A boy's height is measured each birthday, and the heights and ages recorded. Show them by a column graph. Give a title for the graph. Choose your own scale.

| Age in yrs. | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|
| Height in cm | 120 | 123 |  | 129 | 133 | 136 | 139 | 143 |

Using your graph answer the following questions :—

(*a*) What do you think his height was at 9 years ?

(*b*) What was probably his height when he was 12½ years ?

(*c*) Between the ages of 10 and 13½ he grew how many centimetres ?

(5) The average diameter of Pine trees of different ages:

| Age in yrs. | 10 | 20 | 30 | 50 | 60 | 80 | 100 |
|---|---|---|---|---|---|---|---|
| Diameter in cm | 12 | 25 | 34 | 57 | 68 | 92 | 104 |

Draw a column graph and use it to answer the following questions :—

(i) Find the length of the diameter for an age of 40 years or 90 years.

(ii) At what age would the diameter be 98 cm ?

## Continuous Graphs

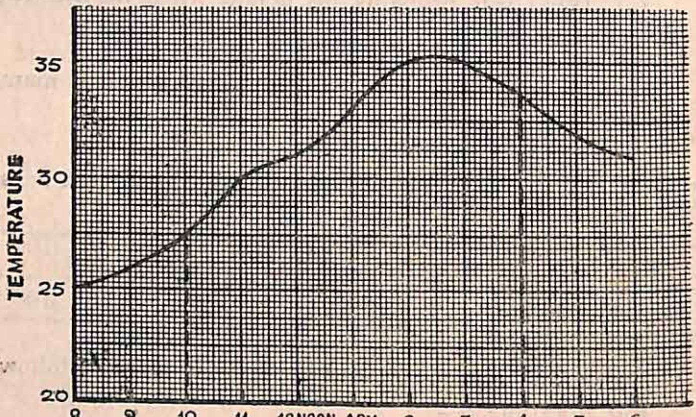
In showing a set of facts by a graph it is not necessary to draw columns. We generally mark only the top point of each column and then join the points by a *smooth curve*.

*Example.* The temperature of a town on a certain day taken at different times is given below. Draw the graph and use it to answer the following questions :

(i) Estimate the temperature at 10 a.m. and 4 p.m.

(ii) What is the rise in temperature between 11 a.m. and 4 p.m. ?

| Time | 8<br>a.m. | 9 | 11 | 12<br>noon | 1<br>p.m. | 2 | 3 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| Temperature in centigrade | 25° | 26° | 30° | 31° | 33° | 35° | 35° | 32° | 31° |



*Ans.* (i) 10 a.m. 27·5°C.
4 p.m. 33·5°C.
(ii) 3·5°C.

## EXERCISES 42

(1) The average monthly temperature of a certain town is given for each month of the year.

| Month | Jan | Feb | Mar | Apr | May | Jun | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tem deg. C | 25 | 27 | 32 | 37 | 39 | 42 | 41 | 35 | 37 | 30 | 28 | 26 |

Draw the graph using as large a scale as possible.

(i) Which are the hottest months ?

(ii) What is the difference between the temperature of February and July ?

(2) The water tank in a school was being filled and the depth taken every hour.

| Time (hrs.) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth in cm. | 40 | 58 | 61 | 82 | | 99 | 107 | 113 | | 124 | 128 |

Draw the graph. What is the depth at the start and after 4 hours and 8 hours ?

(3) The following figures give the depth of water in a swimming pool as the pool is being filled :

| Time (hrs.) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth in cm. | 0 | 32 | 51 | | 85 | 100 | | 127 | 159 | 171 | 180 |

Draw the graph. What was the depth after :—
(i) 3 hours (ii) 6 hours (iii) $4\frac{1}{2}$ hours (iv) $8\frac{1}{2}$ hours ?

(4) The cost per boy per day for food in a boarding school for the years 1951 to 1960 is given :

| Year | '51 | '52 | '53 | '54 | '55 | '56 | '57 | '58 | '59 | '60 |
|---|---|---|---|---|---|---|---|---|---|---|
| Cost in naye paise | 100 | 105 | 114 |  | 138 | 157 |  | 184 | 214 | 225 |

Scale 2 cm to represent 1 year. Horizontal axis 1 cm to represent 10 naye paise. Vertical axis to represent years.

Draw the graph, and use it to answer the following questions :

(i) The cost per boy per day in 1954 and 1957 ?

(ii) How much has the cost increased between 1956 and 1960 ?

## Equations

*Example.* (i)

Solve $x-12=32$.

Because the numbers $x-12$ and 32 are equal, if we *add* 12 to each of them, the results will be equal.

$\therefore x-12+12=32+12$

$\therefore x=44$.

*Example.* (ii)

Solve $a+7=25$.

Because the numbers $a+7$ and 25 are equal, if we *subtract* 7 from each number, the results will be equal.

$\therefore a+7-7=25-7$

$\therefore a \quad =18$.

*Example.* (iii)

Solve $\frac{m}{4}=11$

Because the numbers $\frac{m}{4}$ and 11 are equal, if we multiply each number by 4, the results will be equal.

$\therefore \frac{m}{\cancel{4}}\times\cancel{4}=11\times 4$

$\therefore m=11\times 4=44$.

$\therefore m=44$.

*Example* (iv)

Solve $5l=25$

Because the numbers $5l$ and $25$ are equal, if we *divide* each number by 5, the results will be equal.

$\therefore \frac{5}{5}l=\frac{25}{5}$

$\therefore l=5$

Remember to follow the following four rules when solving a simple equation :

(*a*) Equal numbers may be added to each side.
(*b*) Equal numbers may be subtracted from each side.
(*c*) Each side may be multiplied by equal numbers.
(*d*) Each side may be divided by equal numbers.

## EXERCISES 43

(1) $x+4=11$
(2) $x-5=7$
(3) $y-8=15$
(4) $8+y=17$
(5) $5x=30$
(6) $\frac{x}{5}=6$
(7) $2x=14$
(8) $2x+5=17$
(9) $3x-2=16$
(10) $4x-8=25$
(11) $\frac{2m}{3}=8$
(12) $\frac{8m}{3}=24$
(13) $\frac{2m}{5}=6$
(14) $\frac{4a}{5}=8$
(15) $\frac{5a}{2}=1$
(16) $\frac{2x}{3}=\frac{6}{5}$
(17) $\frac{51}{3}=\frac{11}{2}$
(18) $\frac{2x}{2}+2=7$
(19) $\frac{3x}{5}-3=8$
(20) $\frac{2x}{7}+5=6$
(21) $\frac{3}{4}=\frac{2}{b}$
(22) $\frac{6}{11}=\frac{3}{x}$
(23) $0{\cdot}5\,t=2$
(24) $0{\cdot}8\,m=16$

*Example* (v)

Solve $3x-6=x+10$

1st method. $3x-6=x+10$

or $3x-6+6=x+10+6$ (see rule a)

$\therefore 3x=x+10+6$

$\therefore 3x-x=x-x+10+6$ (see rule b)

$\therefore 3x-x=10+6$

$\therefore 2x=16$

$\therefore x=8$ Ans.

If you look at the 4th line of working and the equation itself you will see that if x is brought to the LEFT the sign changes from + to −. In the same manner − 6 on the left becomes + 6 on the right.

This shows that any term may be moved from either side of an equation to the other side, provided the sign in front of it is changed.

2nd. method. Solve $3x-6=x+10$
$\therefore 3x-x=10+6$ (change sign of x and 6 when moving them to the other side).
$\therefore 2x=16$
$x=8$

*Example* (vi) Solve $5x+9=2x+21$
or $5x-2x=21-9$
or $3x=12$
or $x=4$

## EXERCISES 44

Solve these equations.

(1) $3x-6=2x+10$
(2) $5x+6=2x+9$
(3) $5x+6=2x+21$
(4) $4x+11=x+26$
(5) $8x-3=2x+33$
(6) $13x-5=4x+40$
(7) $4x-10=11-3x$
(8) $8x-3=37-2x$
(9) $17x-4=13x+16$
(10) $13x-4=16-7x$
(11) $4x+9=48-9x$
(12) $6x-10=24-11x$
(13) $9x-7=x+51$
(14) $11x-17=13-4x$
(15) $4x+9=9-12x$
(16) $7+3x=3+5x$
(17) $4x+11=7x+2$
(18) $5x+19=9x-5$
(19) $17-9x=15-8x$
(20) $18-8x=12-5x$
(21) $15-11x=11-7x$
(22) $13+9x=15+5x$
(23) $14-3x=18-5x$
(24) $11-5x=16-10x$

## EASY PROBLEMS ON SIMPLE EQUATIONS

*Example.* (i)

Five times a number exceeds twice the number by nine (Exceeds means 'is greater than').

*Equation.* If x is the number, then
$5x-2x=9$.

*Example* (ii)

Write down an equation for the following statement. If six times a number is added to 5 it is equal to four times the number added to 13.

*Equation* If x is the number

$6x+5=4x+13.$

*Example* (iii)

Write a statement for the given equation.

$3x+7=8x-18$

Statement :—Three times a number added to 7 is equal to 18 subtracted from eight times the number.

## EXERCISES 45

Write statements for the following equations :

(1) $3x=45$ (2) $2x+9=25$ (3) $3x+4=2x+6$

(4) $\frac{x}{5}=15$ (5) $\frac{15}{x}=3$ (6) $7x-9=5x+7$

(7) $2(x+5)=18$ (8) $\frac{x}{3}+4=\frac{x}{5}+6$

In the following problems first write down the equation in x and then solve it.

(9) Six times a certain number exceeds 5 times itself by 16. What is the number.

(10) Eight times a certain number is less than 11 times the number by 15. What is the number ?

(11) Which number multiplied by 7 is less than 9 times itself by 12 ?

(12) Five times a certain number added to 16 is the same as twice the number added to 34. What is the number?

(13) If 9 times a certain number is subtracted from 70 the result is the same as when 7 is subtracted from twice the number. What is the number ?

(14) The sum of two consecutive numbers is 35. Find the numbers.

(15) The three sides of a triangle measure $x+2$; $x-1$ and $x+4$ centimetres. If the perimeter is 31 cm find the length of each side of the triangle.

(16) The length of a rectangle is twice the breadth. If its perimeter is 48 cm, find the sides of the rectangle.

(17) Divide 84 marbles between John, Peter and Jack so that John has four times as much as Jack and Peter has half as much as John.

(18) The sum of three consecutive numbers is 144. What are they ?

(19) When 13 is added to four times a certain number the result is 33. What is the number ?

(20) When 9 is subtracted from three times a certain number the result is 6. What is the number ?

(21) A certain number was multiplied by 5 and the product added to 24. The answer was 39. What is the number ?

(22) Three times a certain number is 16 greater than 11. What is the number ?

(23) The sum of a certain number and 5 is 17 greater than 9. What is the number ?

(24) A number is multiplied by 6 and the product added to 17. The answer is 65. What is the number ?

(25) If 8 times a certain number is subtracted from 90 the answer is 2. What is the number ?

(26) If 5 is subtracted from 5 times a certain number the answer is 55. What is the number ?

(27) A number is divided by 7, and 6 is added to the quotient. The answer is 9. What is the number ?

(28) If 8 is subtracted from one sixth of a certain number the answer is 4. What is the number ?

(29) If 13 is added to a fifth of a certain number the answer is 17. What is the number ?

(30) A number is divided by 8 and the result is added to 37. The answer is 40. What is the number ?

Multiply 7 by 5
or 5 by 7....$7 \times 5$.
Multiply 7 by $a$
or $a$ by 7 ....$7a$
Multiply $a$ by $b$
or $b$ by $a$....$ab$.

## EXERCISES 46

(1) If $x=7, y=3$, and $z=2$, for what numbers do the following stand ?

(*i*) $2x+y$. (*ii*) $3y+2z$. (*iii*) $x+y+z$.
(*iv*) $2x-4y$. (*v*) $x+7z$. (*vi*) $x+y-z$.
(*vii*) $7x+3y$. (*viii*) $3x-2z$. (*ix*) $2x+3y-4z$.

How can 11 be written in code, if the code $x=5, y=3$ is used

| using *only* $x$ ? | using *only* $y$ ? | using *both* $x$ and $y$ ? |
|---|---|---|
| $11=x+6$. | $11=8+y$. | $11=x+2y$. |
| $11=3x-4$. | or $11=2y+5$. | or $11=4x-3y$ |

*Note* :—A number can be written several ways in the same code.

(2) Write these numbers in code. The code is $x=5$, $y=3$. Use both $x$ and $y$ for each number. Only one answer is required for each number.

(*i*) 8 (*ii*) 2 (*iii*) 7
(*iv*) 1 (*v*) 4 (*vi*) 18
(*vii*) 12 (*viii*) 13 (*ix*) 23

(3) Write the first four of the numbers using only $x$.

(4) Write the first four of the above numbers using only $y$.

Shorthand

Multiply 3 by 4, then add 6 . . . . . . . . . . . . . . . $2\times4+6$

Add 4 to 6 and multiply the answer by 3 . . . . . . . . . $(4+6)\times3$

Multiply $a$ by $b$, then add $c$ . . . . . . . $ab+c$

Add $b$ to $c$ and multiply the answer by $a$ . . . . . . . . . . . . . $(b+c)\times a$

Divide 12 by 6 . . . . . . . . . . . $12\div6$ or $\frac{12}{6}$

Divide $a$ by 6. . . . . . . . . . . . . . . . . . . . $\frac{a}{6}$

Divide 6 by $a$. . . . . . . . . . . . . . . . . . . . $\frac{6}{a}$

Divide $a$ by $b$. . . . . . . . . . . . . . . . . . . . $\frac{a}{b}$

Add $a$ to $b$ and divide the answer by $c$ . . . . . . . . . . . . . $\frac{a+b}{c}$

## EXERCISES 47

(1) Cover up the right-hand side items given above. See if you can write the items on the left-hand side in *shorthand*. Check your answers.
Then cover up the left-hand side and see whether you can write the items on the right-hand side in *words*. Check your answers.

(2) Remember the order of signs ( ); ÷; ×; + or —.
If a=12, $b=4$, $c=3$, $d=8$, $e=16$ and $f=20$,
for what numbers do these stand ?

1. $\frac{a}{b}$ 2. $ab$ 3. $6a+5$ 4. $\frac{a}{b}+7$

5. $e+\frac{b}{f}$ 6. $b-\frac{c}{a}$ 7. $ab+c$ 8. $6-\frac{f}{b}$

9. $\frac{e}{b}-4$ 10. $7c-5$ 11. $a+f-e$ 12. $2a+3b-4$

13. $\frac{e}{d}+a$

14. $\frac{e+a}{d}$

15. $ad+bc$

16. $(a+b)\times 7$

17. $a+7b$

18. $(a+7)\times b$

19. $\frac{a+b}{c}$

20. $\frac{f}{e+b}$

21. $(c+b)\times f$

22. $b-\frac{c}{d}$

23. $\frac{b-c}{a}$

24. $a-\frac{b}{d}$

## Construction of Formulae

*Example* (i) The area of a rectangle.

We have already learnt that if the length of a rectangle is $l$ cm and breadth b cm. Then the area is

$$A=l\times b \text{ sq. cm.}$$

This relationship is called a *formula.*

## EXERCISES 48

(1) A box is 5 cm long, 4 cm wide and 3 cm high. What is the volume of the box ? If the lengh is 'a' cm breadth 'b' cm and height 'c' cm, what is the volume of the box ?

(2) To make a pot of tea, put one spoonful for each person and one for the pot. How much tea is required for (a) 5 people (b) 7 people (c) x people ?

(3) Make up a formula for the time a train takes to travel x kilometres at y kilometres per hour.

(4) How many times can a jug holding 'p' litres be filled from a tub holding 'S' litres.

(5) A book is 'x' cm thick, each cover is q cm thick and there are 'p' sheets. What is the thickness of each sheet? (Make up a similar problem using numbers.)

(6) A boy's stride is x cm. In how many strides will he cover (i) 5 metres (ii) 'y' metres ?

(7) The greatest of four even numbers is K. What is the least ?

(8) What is the next odd number after (i) 21 (ii) after K if K is odd (iii) if K is even ?

(9) A magazine costs 'y' naye paise. How many magazines can be bought for x rupees ?

(10) Five years ago I was '3 m' years old; how old shall I be in five years' time ?

(11) The sum of 7, 8, 9 is three times 8.
The sum of 19, 20, 21 is three times 20.
The sum of A, $A+1$, $A+2$ is............?
The sum of $A-1$, A, $A+1$ is............?

(12) The sum of 8 and 10 is twice 9.
The sum of 13 and 15 is twice 14.
What is the general statement ?

(13) $5^2-3^2=4\times4$.
$9^2-7^2=4\times8$

Write a general statement to include the above facts.

(14) If a boy gets 12 marks out of a maximum 20. What is his percentage ? If he obtained x marks out of a maximum of 'p' what is his percentage ?

(15) A man buys an article for Rs. 10 and sells it for Rs. 12. What is his actual profit ? What is his percentage profit ? If he bought the article for Rs. 4 and sold it for Rs. P find (i) the actual profit (ii) the percentage profit.

(16) N chains were bought for Rs. 90. Find the cost of (a) one chain (d) x chains (c) 2n chains.

(17) A ribbon is 2 metres long. How many pieces each measuring (a) 5 cm (b) p cm (c) 2q cm can be cut ?

(18) The perimeter of a square is P centimetres. Find the length of the side.

(19) How many seconds are there in (a) 30 minutes (b) 2 hours (c) q minutes (d) 'I' hours ?

(20) A score of eggs cost Rs. 3. Find the cost of p eggs giving your answer in naye paise.

*Example* (i) If 'a' stands for 5 what is the value of

$$\frac{a+5}{a}?$$

$$a=5 \quad \therefore \frac{5+5}{5}=\frac{10}{5}=2$$

*Example* (*ii*)

If $p=2$. What is the value of (i) $3\,p$ (ii) $4\,p-2$ (iii) $p^2$ (iv) $\frac{8}{p}$?

Now $p=2 \;\therefore\; 3p=3\times p=3\times 2=6$

and $4p-2=4\times p-2=4\times 2-2=8-2=6$

and $p^2=p\times p=2\times 2=4$

and $\frac{8}{p}=\frac{8}{2}=4.$

## EXERCISES 49

If $A=8$, $r=3$, $t=1$, find the values of :

(1) $2\,A$ (2) $A^2$ (3) $\frac{A}{2}$ (4) $A+4$

(5) $A-5$ (6) $\frac{A}{2}$ (7) $A^2$ (8) $3A+4$

(9) $A+t$ (10) $A-t$ (11) $A\div r$ (12) $3A\div r$

(13) $r^2$ (14) $2r^2$ (15) $3r-t$ (16) $3A-2r$

(17) $r+t$ (18) $A\,r\,t$ (19) $3\,t\,r^2$ (20) $At+r$

(21) $t\,r+A$.

If $a=2$, $b=3$, $c=8$, find the values of the following :—

(22) $C-2$ (23) $\frac{b+c}{4}$ (24) $\frac{a+c}{5}$ (25) $abc$

(26) $2\,ab+c$ (27) $3\,c-ab$ (28) $\frac{bc+ab}{a}$

(29) $ac-ab$ (30) $bc-10\,a$ (31) $ab+bc+ca$

(32) $abc-bc$ (33) $a^2+b^2+c^2$ (34) $c^2-b^2-a^2$

(35) $bc-a^2+b^2$ (36) $2b+3c-4a$

*Example*

How many hockey sticks at Rs. 7·25 each can be bought for Rs. 130·50?

Rs. 7·25= 725 nP.
Rs. 13050=130·50 nP

The question now becomes :

How many times does 725 go into 13050 ?

```
        18
   725)13050
        725
        5800
        5800
         ..
```

*Ans.* 18 hockey sticks.

## EXERCISES 50

(1) How many ash trays at 30 nP. each can be bought for Rs. 7·50 ?

(2) How many tins of jam at Rs. 1·36 each can be bought for Rs. 28·35 ?

(3) How many dolls at Rs. 5·80 each can be bought for Rs. 40·60 ?

(4) How many fountain pens at Rs. 3·55 can be bought for Rs. 60·35 ?

(5) How many pair of socks at Rs. 4·45 can be bought for Rs. 66·75 ?

(6) An iron bar weighs 76 gm. How many bars will weigh 2 Kg 128 gm ?

(7) A meccano set costs Rs. 31·50. How many sets can I buy for Rs. 661·50 ?

(8) A man walks I Kilometre in 23 minutes. How far would he walk in 8 hours 59 minutes ?

(9) How many pieces of ribbon 65 cm long can be cut from a roll of ribbon 17 m 55 cm ?

(10) If a tile is 7 cm long and 5 cm wide, how many tiles will cover a space of 7 sq. metres ?

(11) Find the cost of 42 articles at Rs. 15·32 each.

(12) How many cinema tickets at Rs. 1·20 each can be had for Rs. 10, and how much will be left over ?

(13) A mug can hold 450 cc of water, and a basin 4½ litres. How many mugs of water will fill the basin ?

(14) A cricket bat costs Rs. 26·50. How many bats can be had for Rs. 170 ?

(15) How many pieces of wire 22 metres long can be cut from a piece 50 metres long ? What length will be left over ?

(16) A cricket bat costs Rs. 24·75. Find the cost of 21 bats.

(17) How many hours are there in 72 days ?

(18) A man works each day for 5½ hours. He is paid Rs. 2·40 an hour. How much does he earn in 15 days ?

(19) How many 40-minute lessons can be given in 3 hours 20 minutes ?

(20) A party had to pay Rs. 36·45 for bus fares. If each fare was Rs. 1·35, how many were in the party ?

(21) A book costs Rs. 3·36. Find the difference in price between 37 copies and 28 copies of it.

(22) Electric trains pass a certain station every 11 minutes. How many trains pass in 12 hours 28 minutes ?

(23) What fraction of 3 hours is 2⅓ hours. ?

(24) An American dollar is equal to Rs. 4·65. How many rupees is equal to 17 dollars ?

(25) An American dollar is equal to Rs. 4·65. How many dollars are equivalent to Rs. 102·30 ?

(26) A British pound (£) is equivalent to Rs. 13·33. What is the value in rupees of £26 ?

(27) A tin of paint will cover 27 sq. metres. How many such tins will be required to cover 783 sq. metres ?

*Example*. Divide Rs. 48 in the ratio 3 : 5

This means that Rs. 48 is to be divided in 3+5=eight equal shares. Three shares will make up one part and 5 shares the other.

Divide Rs. 48 by 8. (3+5=8)
∴Each share is Rs. 6. (48÷8=6)
So 3 shares will be equal to Rs. 6×3=Rs. 18
and 5 shares will be equal to Rs. 6×5=Rs. 30

Total Rs. 48

*Answer* Rs. 18; Rs. 30.

### EXERCISES 51

(1) Divide Rs. 40 in the ratio (i) 2:3 (ii) 3:5 (iii) 1:3
(2) Divide Rs. 60 in the ratio (i) 1:5 (ii) 2:3 (iii) 5:7
(3) Divide 128 cm in the ratio (i) 3:5 (ii) 7:9 (iii) 1:7
(4) Divide Rs. 8·40 in the ratio (i) 2:5 (ii) 3:4 (iii) 1:2
(5) Divide 3 hours 40 minutes in the ratio (i) 5:6 (ii) 3:2 (iii) 3:8
(6) Divide Rs. 24 in the ratio 1:2:3.
(7) Divide Rs. 132 in the ratio 2:4:5.
(8) Divide Rs. 750 in the ratio 5:7.
(9) In a test 60 marks are distributed between 3 questions so that the marks are in the ratio 3:5:7. Find the marks for each question.
(10) A legacy of Rs. 9000 is divided among 3 sons in the ratio of 2:3:4. Find the share of each son.

## SCALE DRAWING

### DISTANCE AND DIRECTION

(See pp. 118 & 119)

### EXERCISES A

Use squared paper. In answering each question take a point O (as the starting point and draw the east-west and north-south lines through O). Measure to the nearest Kilometre.

(1) A man starts from O and cycles 10 Km due north. He then cycles 15 Km due east. How far is he from the starting point ? (Scale 1 cm=1 Km)

(2) Two men set out from O. How far apart are they after one has walked 15 Km due south and the other 8 miles due west ? (Scale 1 cm=1 Km.).

(3) A railway track runs S.W. from 0, and a motor road S.E. from 0. A train and a motor bus leave 0 at the same time, the train travelling at 60 Km an hour and the bus 44 Km an hour. How far apart are the train and the bus after $\frac{3}{4}$ hr ? (Scale 1 cm=4 Km).

(4) One building is 3·2 Km due east of O and another is 2·7 Km. How far apart are the buildings ? (Scale 1 cm=1 Km, : $\frac{1}{10}$ cm =0.1 Km).

(5) A ship leaves O and sails 8·5 Km in a northwesterly direction. It then changes course and travels due east for 10·5 Km and finally 12 Km in a northeasterly direction. Find the distance of ship from its starting point to the nearest Kilometre. (1 cm=1 Km).

(6) A and B are two towns 45 Km and 60 Km respectively away from a town O. A is N. W. of O and B is due east of O. Find by scale drawing the distance of A from B. (Scale 1 cm=5 Km).

(7) X and Y are two towns 70 Km and 55 Km respectively away from a town O. X is S.W. of O and Y is S.E. of O. Find by scale drawing the distance of X from Y. If a road runs direct from X to Y, find the shortest distance of O from the road. Use your own scale.

## GEOMETRY

## THE ANGLES BETWEEN TWO STRAIGHT LINES

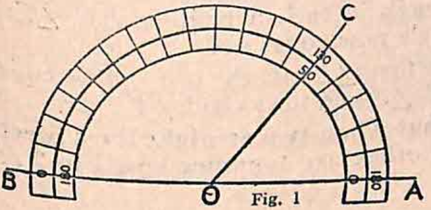


Fig. 1

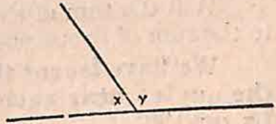


FIG 2

In fig 1 the measurement of $\angle AOC$ has been read on the lower scale and found to be $50^\circ$

The $\angle BOC$ has been read on the upper scale and found to be $130^\circ$

Can we tell the measurement of $\angle BOC$ without reading the top scale ?

Imagine the line $OC$ to be revolving from the position $OA$ in the opposite direction to the hands of a clock. How many degrees will it turn through by the time it takes up the position $OB$ ?

At the position $OC$ shown in the fig. 1 the revolving line has turned through an angle of 50°. How many more degrees has it to turn through to arrive at the position $OB$ ?

How, then, can we find the measurement of $\angle BOC$ without reading the upper scale ?

## EXERCISES B

Fill in the blanks below.

When

1. $\angle AOC=40^\circ$ $\angle BOC=$
2. $\angle AOC=29^\circ$ $\angle BOC=$
3. $\angle AOC=51^\circ$ $\angle BOC=$
4. $\angle AOC=63^\circ$ $\angle BOC=$

When

5 $\angle BOC=100^\circ$ $\angle AOC=$
6. $\angle BOC=125^\circ$ $\angle AOC=$
7. $\angle BOC=136^\circ$ $\angle AOC=$
8. $\angle BOC=156^\circ$ $\angle AOC=$

Place two pencils or a pen and a pencil, in the positions of the lines shown in fig. 2.

Make one line revolve till it traces out $\angle X$, then make it revolve further so as to trace out $\angle Y$. Through how many degrees has it revolved altogether ?

## VERTICALLY OPPOSITE ANGLES

Now place the pencils in such a position that $\angle X = \angle Y$. What is each angle now equal to ?

Will the sum of the first $\angle X$ and the first $\angle Y$ be equal to the sum of the second $\angle X$ and the second $\angle Y$ ?

**We have learnt that when two straight lines meet, the angles near each other are together equal to 2 rt. Ls or 180°.**

On a piece of tracing paper draw two intersecting lines $AB$ and $CD$ as you see done in fig. 3. $O$ is called the point of intersection. See if you can fold the paper so that $\angle AOD$ folds exactly over $\angle BOC$.

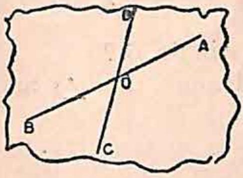


FIG 3

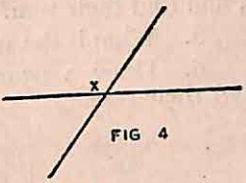


FIG 4

What do you know about the angles $AOD$ and $BOC$? And angles $BOD$ and $COA$?

Look again at fig. 3. Use your pencil for a revolving line. Put it on $BA$ with the point towards $A$. Revolve the pencil about $O$ till one end falls along $OD$. This end has turned through the $\angle AOD$. Through what angle has the other end turned?

$\angle BOC$ and $\angle DOC$ are called **vertically opposite** angles.

So also are $\angle s$ $BOD$ and $COA$.

**When two st. lines intersect four angles are formed. Of these, any two that are near each other are together equal to two right angles; and vertically opposite pairs are equal.**

## EXERCISES C

1. Draw any two lines as you see done in fig. 4. Measure $X$. Then write down the measurements of the other angles without actually measuring them.

2. What are the other angles if $\angle X=$

(*a*) 120°
(*b*) 90°
(*c*) 80°
(*d*) 150°
(*e*) 163°

3. What is the sum of $\angle$s $a$, $b$, $c$, $d$, in fig. 5 ?

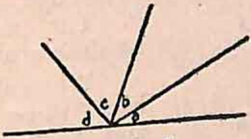


Fig. 5

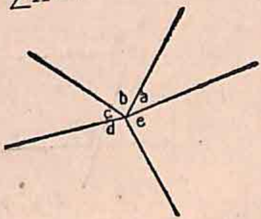


Fig. 6

4. Draw a figure like fig. 5. Measure the ∠*s a*, *b*, *c*, *d*, and find their sum.

5. What is the sum of ∠*s a*, *b*, *c*, *d*, *e* in fig. 6 ?

6. Draw a figure like fig. 6. Measure the ∠*s* and find their sum.

## PARALLELS

Place your set square in any position as you see done in fig. 7. Place your ruler along one edge. Hold the ruler firm and slide your set square up and down, keeping its edge against the ruler. In a number of positions of the set square, draw the lines *AB*.

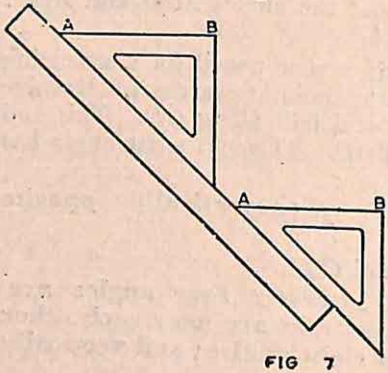


FIG 7

Now remove the ruler and set square. All the lines *AB* are parallel to one another.

See fig. 8. How can a line be drawn through the point P parallel to *AB*?

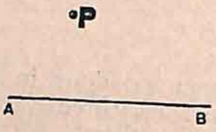


FIG 8

We first place our set square with one edge along *AB*. We then slide it up along a ruler till the edge passes through *P*. The parallel line will be drawn along the edge.

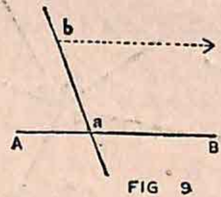


FIG 9

When angles are placed like those marked *a* and *b* in fig. 9 they are called **corresponding angles.** There is another pair of corresponding angles in the figure. Point them out.

We can tell whether or not two lines are parallel by drawing any line across them and measuring a pair of corresponding angles. If these angles are equal the lines must be parallel. If they are not equal, the lines are not parallel.

Let us return to the problem of fig. 8 and draw a line through P parallel to $AB$ without using a set square.

We first draw any st. line through P to cut $AB$. Fig. 9 shows the line drawn. We now measure off with the protractor $\angle b = \angle a$. This gives us a line parallel to $AB$.

**To copy an angle:** We can copy an angle without measuring it with a protractor. Figs. 10(*a*) and 10(*b*) show how this is done.

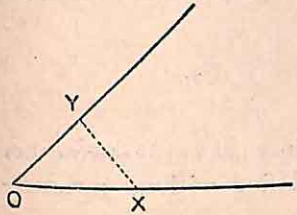


Fig. 10 (*a*)

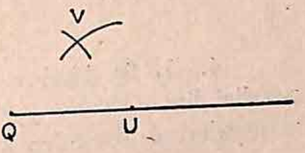


Fig. 10 (*b*)

Fig. 10 (*a*) shows the given angle. We first mark off any two points $Q$ and $Y$ on the two arms.

Then we take another line [Fig. 10 (*b*)] and copy the *triangle* $XOY$ on it. $QU$ is marked off equal to $OX$. Then, with centres $Q$ and $U$, arcs are struck at $V$ with radii equal to $OY$ and $XY$. In copying the triangle $XOY$ we have at the same time copied the $\angle XOY$.

## EXERCISES D

1. Ask your neighbour to draw an angle in your exercise book. Copy it in each of these ways :

(*i*) using a tracing paper.
(*ii*) using a protractor.
(*iii*) using only the compasses and ruler.

2. Take straight line and a point outside. it. Throug the point draw a line parallel to the given line without usin either a set square or a protractor.

3. In fig. 11, two parallel lines are cut by a third lin Suppose $\angle a=65^\circ$. Find $\angle b$ and all the other angles i the figure.

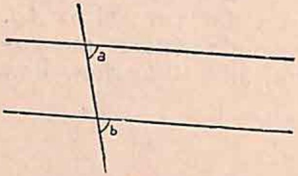


Fig. 11

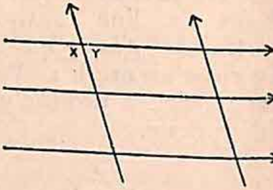


Fig. 12

4. In fig. 12 three parallel lines are cut by two othe parallel lines. Take $\angle Y=73^\circ$ and find without measurement what all the other angles are.

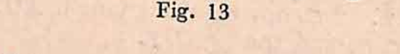


Fig. 13

5. Fig. 13 shows another way of drawing a line through $P$ parallel to $AB$. We first use the set square to draw a perpendicular $PN$. Then a rectangle is drawn with sides $PN$ and $NR$. The side $PS$ is parallel to $AB$. Why is this? Go through the construction yourself.

'$AB \parallel CD$' is read '$AB$ is parallel to $CD$'.

Draw a triangle on a piece of paper and cut it out.

Mark the angles *a*, *b*, and *c*, as you see done in fig. 14(*a*).

Tear off the angles. Place them alongside each other as in fig. 14 (*b*). What do you notice ?

What is the sum of the angles of the triangle ?

Repeat the experiment with another paper triangle.

Draw a triangle and measure the angles. Find the sum.

**The sum of the angles of a triangle is 2 rt. ∠s or 180°.**

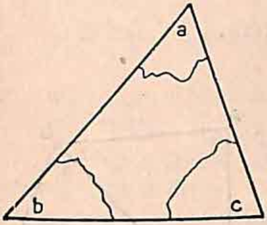


Fig. 14 (a)

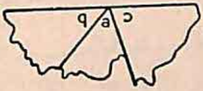


Fig. 14 (b)

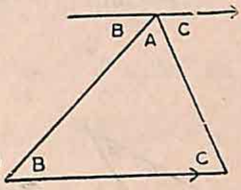


Fig. 15

In fig. 15 you will notice two ∠*s* marked '*B*'.

These are **alternate angles.**

Turn back to fig. 11 and mark off the angle alternate to *a*.

Turn back to fig. 12 and mark off two angles alternate to *Υ*.

In fig. 11 name the angle alternate to *a*.

$\angle a = \angle b$. Why?

**When a st. line is drawn to cut parallel lines, corresponding angles are equal and alternate angles are also equal.**

In fig. 15 a line is drawn through a vertex parallel to the opposite side. Alternate angles are equal and are, therefore, marked alike.

Can you use this figure to tell the sum of the angles of a triangle?

In fig. 16 the arrowed lines are parallel.
Point out an angle alternate to *a*.
Point out an angle corresponding to *b*.
Can you use fig. 16 to tell what the sum of the angles *a*, *b*, *c* is?

In fig. 17 the arrowed lines are parallel.
What two angles correspond to ∠*m* ?
What two angles are alternate to ∠*m* ?
What do you know about ∠*m* and ∠*r* ?
What do you know about ∠*a* and ∠*r* ?
What do you know about ∠*a* and ∠*m* ?
Two of the angles are known.
(One is 65° and the other 80°).
Find all the other angles in the figure.

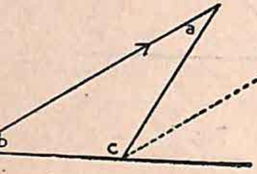


Fig. 16

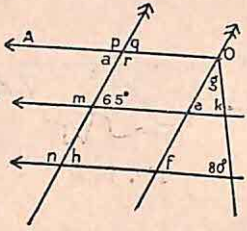


Fig. 17

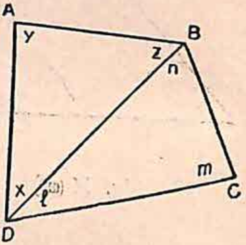


Fig. 18

Any four-sided figure is called a quadrilateral.

In fig. 18 the diagonal divides the quadrilateral up into two triangles.

What is the sum of *x*, *y*, *z* ?
What is the sum of *l*, *m*, n ?
What is the sum of the angles of a quadrilateral ?

Draw a quadrilateral. Measure the angles with your protractor. Add them up to find the sum.

Look at fig. 14 (*a*) and fig. 14 (*b*). Try the same experiment for quadrilateral. Draw a quadrilateral. Mark the angles *a*, *b*, *c*, *d*. Tear them out and then put them together. What do you notice?

## EXERCISES E

1. Construct triangle $ABC$ to the following measurements. Measure the angles and find their sum.

(a) $AB=5{\cdot}5$ cm.; $BC=4{\cdot}3$ cm.; $CA=6{\cdot}1$ cm.
(b) $AB=5{\cdot}6$ cm.; $BC=4{\cdot}9$ cm.; $CA=7{\cdot}2$ cm.
(c) $AB=5{\cdot}6$ cm.; $BC=7{\cdot}2$ cm.; $CA=4{\cdot}3$ cm.
(d) $AB=7{\cdot}5$ cm.; $BC=6{\cdot}9$ cm.; $CA=5{\cdot}7$ cm.

2. In the following, two angles of a $\triangle$ are given. Find the third angle.

(a) $\angle A=35^\circ$; $\angle B=90^\circ$
(b) $\angle C=120^\circ$; $\angle A=30^\circ$
(c) $\angle B=45^\circ$; $\angle C=100^\circ$
(d) $\angle A=75^\circ$; $\angle B=30^\circ$
(e) $\angle B=49^\circ$; $\angle C=63^\circ$
(f) $\angle A=60^\circ$; $\angle B=60^\circ$

An angle which is less than a right angle is called an **acute angle.**

An angle which is greater than a right angle is called a an **obtuse angle.**

Can a triangle have more than one right angle ?
Can a triangle have more than one obtuse angle ?

A triangle with one of its angles a right angle is called a **right-angled triangle.**

A triangle with one of its angles an obtuse angle is called an **obtuse-angled triangle.**

An **acute-angled triangle** has all three of its angles acute angles.

3. Construct these triangles and write down opposite them whether they are acute-angled, right-angled or obtuse-angled.

(a) $AB=7$ cm. $BC=6$ cm. $CA=5$ cm.
(b) $AB=5$ cm. $BC=4$ cm. $CA=3$ cm.
(c) $AB=6$ cm. $BC=4$ cm. $CA=3$ cm.

4. Draw a $\triangle ABC$ with $\angle A=50^\circ$; $\angle C=70^\circ$; $AC=5{\cdot}8$cm.
5. Draw a $\triangle ABC$ with $\angle A=50^\circ$; $\angle C=60^\circ$; $AB=6$cm.

If both pairs of opposite sides of a quadrilateral are parallel the figure is called a **parrallelogram.**

There are two parallelograms in fig. 17. Mark them out.

If only one pair of sides are parallel, the quadrilateral is called a **trapezium.**

*ABDE* of fig. 19 is a trapezium.

So also is *ACDE.*

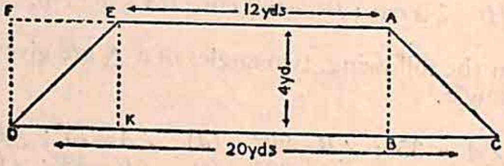


Fig. 19

Can you name another trapezium in fig. 19 ?

If *AC=DE, ACDE* is called an isosceles trapezium.

If *ACDE* is an isosceles trapezium, find its area.

Use the measurements given in the diagram.

## DIVIDING A LINE INTO EQUAL PARTS

Fig. 20 shows a scheme for dividing a line up into a number of equal parts.

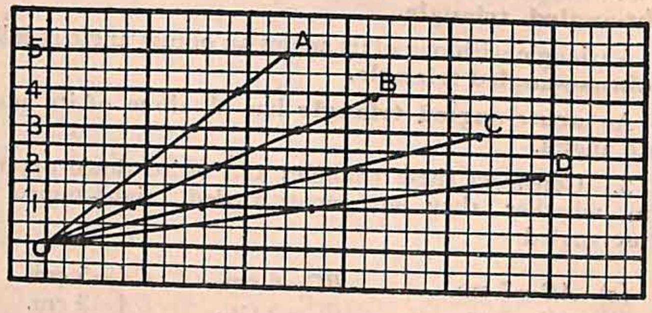


Fig. 20

A number of parallel lines are drawn the same distance apart. The work is easier if squared paper is used.

Suppose we wished to divide a line up into 4 equal parts. We would take its length up on our compasses and with centre *O* would cut an arc at *B* on the line marked 4. *OB* is a copy of the line and the parallels 1, 2, 3, 4 divide it up into 4 equal parts.

*OA* shows how a line can be divided up into 5 equal parts. What do *OC* and *OD* show ?

## EXERCISES F

On squared paper draw your own scheme of parallel lines.

Take a line and divide it up into 5 equal parts.
Take a line ,, ,, ,, ,, ,, 4 equal parts.
Take a line ,, ,, ,, ,, ,, 6 equal parts.
Take a line ,, ,, ,, ,, ,, 3 equal parts.

## LINE CONNECTED WITH A TRIANGLE

**A scalene** triangle has no two of its sides equal.

Draw a scalene triangle on a piece of paper. Name the vertices *A*, *B* and *C*, and cut out the triangle. Fold *BC* *on itself* so that the crease will pass through *A*. (See fig. 21).

Name the point on which *C* falls '*c*'.

Open out the triangle and rule a line along the crease. This line is the perpendicular from *A* on *BC*. It is a height of the $\triangle$.

There are two other heights. How can they be drawn?

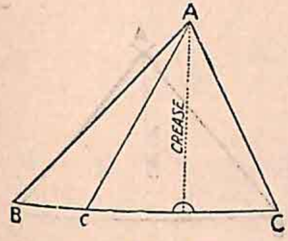


Fig. 21

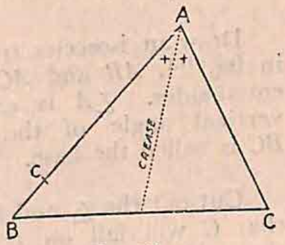


Fig. 22

Draw a scalene $\triangle ABC$ and cut it out. (The letters *A*, *B*, *C* will have to be written inside the $\triangle$ and not outside it as it has been done in the diagram.) Fold *AC* so that it will fall along *AB*.

Does *C* fall on *B* ? Why not ?

Open out the triangle and rule a line along the crease. This line is the bisector of ∠*A*.

Obtain the bisectors of ∠*B* and ∠*C* in the same way.

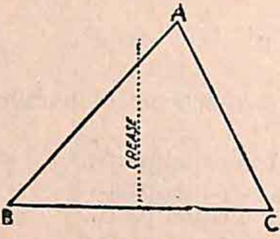


Fig. 23

Draw a scalene △*ABC* and cut it out. Fold the triangle so that the point *C* falls on the point B. Crease, then open out the △ and rule a line along the crease. This line is the perpendicular bisector of *BC*. It is perpendicular to BC and also bisects *BC*.

Fold again so as to obtain the perpendicular bisectors of the other two sides.

## THE ISOSCELES TRIANGLE

We have just learnt about three important lines in a △ :—

(*i*) the perpendicular from a vertex to the opposite side, (*ii*) the bisector of an angle, (*iii*) the perpendicular bisector of a side.

Draw an isosceles triangle as in fig. 24. *AB* and *AC* are the equal sides. ∠*A* is called the vertical angle of the △ and *BC* is called the base.

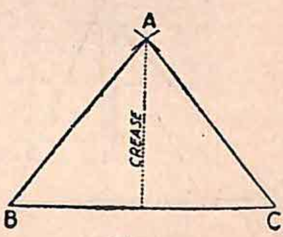


Fig. 24

Cut out the △ and fold it so that *C* will fall on *B*. Notice that *AC* falls exactly on *AB* and that the crease stands for all three of the important lines mentioned above.

**In an isosceles △ the perpendicular bisector of the base also bisects the vertical angle.**

Supose we wish **to draw the perpendicular bisector** of a st. line *AB* [Fig. 25 (*a*)] without folding the line or measuring it, or using a set square or a protractor.

Fig. 25 (*b*)

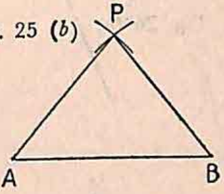


Fig. 25 (*a*)

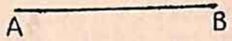


Fig. 25 (*b*) shows the first step. With any radius and *A* and *B* as centres we strike arcs at P. This gives us an isosceles △ *PAB*. The perpendicular bisector, we know, must pass through *P*.

Fig. 25 (*c*)

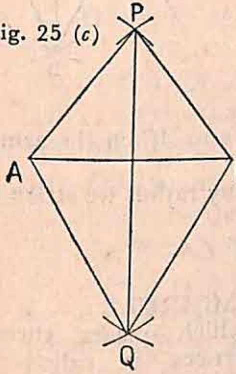


Fig. 25 (*d*)

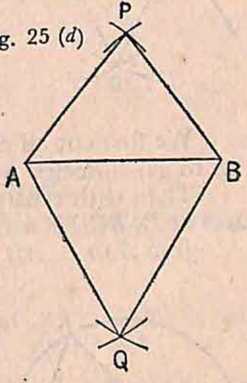


Fig. 25 (*c*) shows another isosceles △ *QAB* drawn on the other side of *AB*. The perpendicular bisector, we know, must also pass through *Q*.

*PQ*, then, must be the perpendicular bisector.

We can also use isosceles triangles to bisect an angle. Suppose we wish to bisect angle *A* (Fig. 26*a*).

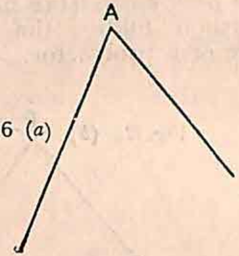


Fig. 26 (*a*)

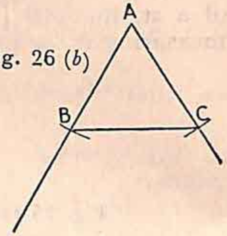


Fig. 26 (*b*)

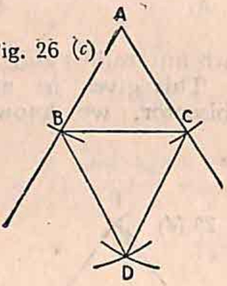


Fig. 26 (*c*)

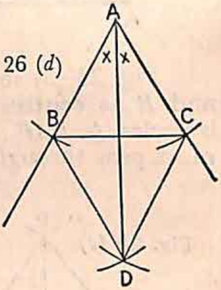


Fig. 26 (*d*)

We first cut off equal lengths *AB* and *AC* on the arms so as to get isosceles △ *ABC*.

Then with centres *B* and *C* and any radius we strike two arcs at *D*. *BCD* is another isosceles △.

Join *A* to *D*. *AD* is the bisector of ∠*A*.

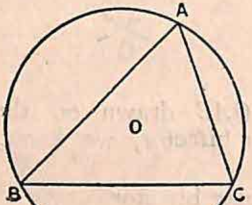


Fig. 27

## THE CIRCUMCIRCLE

The circle which passes through the three vertices is called the **circumcircle** of the triangle.

To find its centre *O*, we draw the perpendicular bisectors of any two sides. The point where they meet is *O*. When we have found *O* we take for radius any one of the lengths, *OA*, *OB*, *OC*, (they are all equal) and draw the circle.

## THE INCIRCLE

The circle which touches the three sides is called the **incircle** of the triangle.

To find its centre, *I*, we draw the bisectors of any two of the angles. The point where they meet is *I*.

*I* will be found to be at the same distance from all three sides. We can use our set square to find this distance, which is the radius of the circle.

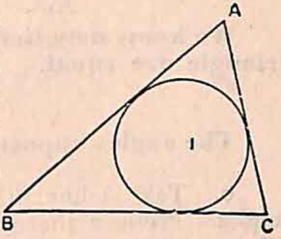


Fig. 28

## CONSTRUCTIONS

### EXERCISES G

1. Construct the following triangles and their circumcircles :

(*a*) $A=50°$; $B=80°$; $AB=6$ cm.

(*b*) $B=75°$; $C=55°$; $BC=7$ cm.

(*c*) $AB=BC=CA=5{\cdot}4$ cm.

(*d*) $BC=5$ cm.; $CA=4$ cm.; $AB=3$ cm.

2. Construct the following triangles and their incircles.

(*a*) $A=90°$; $C=48°$; $AC=6$ cm.

(*b*) $A=75°$; $C=32°$; $AC=7$ cm.

3. See fig. 18. You are given that $AB=5$ cm.; $BD=9$ cm.; $CD=7$ cm.; $BC=6$ cm.; $AD=7$ cm.

Construct the quadrilateral. Measure the angles and their sum.

4. Construct a quadrilateral *ABCD*, given that $A=85°$; $AD=9$ cm.; $AB=7$ cm.; $CD=6$ cm.; $BC=8$ cm.

5. Construct a quadrilateral *ABCD*, given that $C=70°$; $CD=8$ cm.; $CB=6$ cm.; $AD=9$ cm. $AB=8$ cm.

Turn back to fig. 24. Imagine the △ folded so that $C$ falls on $B$. Will the line $AC$ fall on $AB$? What do you know about ∠s $B$ and $C$?

Ans. $\angle B = \angle C$.

**We know now that the base angles of an isosceles triangle are equal.**

*or*

**The angles opposite the equal sides are equal.**

6. Take a line $BC$ and at $B$ and $C$ make two equal angles. Produce the arms so as to form a triangle $ABC$. Measure $AB$ and $AC$. Is the △ isosceles?

7. The base angles of an isosceles △ are 47° each. What is the vertical angle?

8. The vertical angle of an isosceles △ is 66°. What are the base angles?

## SUMMARY OF GEOMETRICAL FACTS.

(1) When two straight lines cut, the angles near each other are together equal to 180° or two rt. angles; and the vertically opposite angles are equal.

(2) The sum of the angles of a triangle is 2 rt. angles.

(3) If a straight line is drawn to cut parallel lines,

  (*a*) the alternate angles so formed are equal.

  (*b*) the corresponding angles so formed are equal.

(4) The base angles of an isosceles triangle are equal.

(5) In an isosceles triangle the perpendicular bisector of the base also bisects the vertical angle.

## EXERCISES H.

Use the above facts to solve the questions given below:

(1) The vertical angle of an isosceles triangle is 110 degrees; find the base angles.

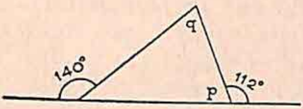
(2) The vertical angle of an isosceles triangle is 72 degrees; find the other angles.

(3) One base angle of an isosceles triangle is 48°. Find the other angles.

(4) The angles of a triangle are $x^\circ$, $2x^\circ$ and $3x^\circ$. Find the angles of the triangle.

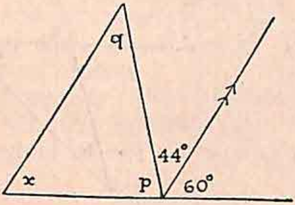
(5) Find the value of angle 'p' and angle 'q'.

$p^\circ + q^\circ =$ ?



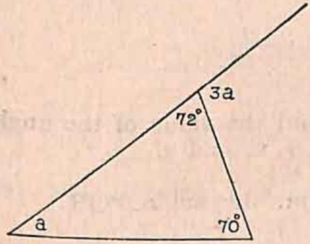
(6) Find the value of angles x, p and q.

$q + x =$ ?



(7) Find the value of angles a and 3a.

$a + 70^\circ =$ ?

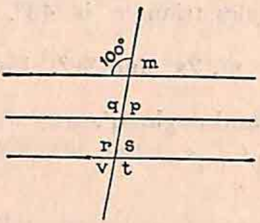


Using the results of questions 5, 6 and 7, what two angles is the exterior angle of a triangle equal to ?

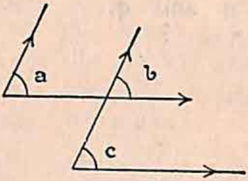
(8) ABC is a triangle.
If $A = 45^\circ$ and $B = 115^\circ$, find angle C.
If $C = 28^\circ$ and $A = 79^\circ$, find angle B.

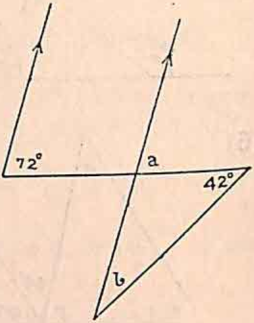
(9) The angles of a triangle are $(x+2)^\circ$, $(x+5)^\circ$, $(x+8)^\circ$. Find the value of x and the angles of the triangle.

(10) Find the angles m, p, q, r, s, t and v.



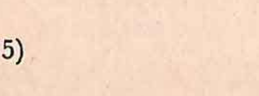
(11) If angle b=72° find angles 'a' and 'c'

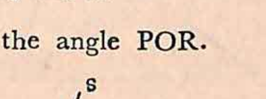




(12) Find the angles 'a' and 'b'

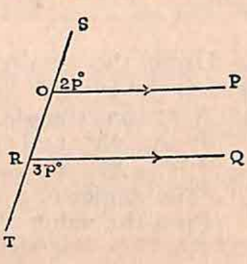
(13) Find the value of angle 'a'.





(14) Find the value of the angle q, y, z, and x.

(15) Find the angle POR.



(16) Construct the triangle ABC such that AB=7 cm, angle A=69° and angle B=74°. Construct the incircle of the triangle and measure its radius.

(17) Construct the triangle PQR such that PQ=6·8 cm, QR=5·9 cm and angle PQR=79°. Construct the circumcircle of the triangle and measure its radius.

(18) Construct the quadrilateral ABCD such that AB=8 cm, BC=9 cm, ∠ABC=85°CD=7 cm and DA=8·5 cm. Measure the angles and their sum.

(19) Construct the triangle XYZ such that XY=7 cm, YZ=6·2 cm and ZA=5·9 cm. Construct the incircle and circumcircle of the triangle. Measure the radius of each of the circle. Find the distance between the two centres.

(20) Construct the triangle ABC in which AB=8 cm, BC=12 cm and CA=13 cm. Construct the circle which passes through the vertices of the triangle.

## REVISION TESTS

### (1)

(1) Add 8627; 7269; 4518; 6214.
(2) Express 567 in prime factors.
(3) $2\frac{1}{2}+3\frac{1}{8}-1\frac{3}{4}$.
(4) $3{\cdot}796 \times 9$.
(5) If $a=3$, $b=4$, $c=6$, find the value of $b+ac+bc$.

### (2)

(1) $23{\cdot}07 \times 11$.
(2) Find the LCM. of 27, 48, 56 in prime factors.
(3) $1{\cdot}28 \div 8$.
(4) Three angles of a quadrilateral are 75°, 87°, 105°. Find the fourth angle.
(5) Solve $\frac{3}{2p}=\frac{5}{3}$.

### (3)

(1) Find the prime factors of 11025.
(2) Simplify $3\frac{1}{4}-2\frac{2}{3}+4\frac{1}{6}$.
(3) Simplify $7{\cdot}23+5{\cdot}09+1{\cdot}02-0{\cdot}01$.
(4) Simplify $\frac{4}{5}$ of $4\frac{2}{7}\div 2\frac{2}{3}$.
(5) Share Rs. 350 in the ratio 1:2:4.

### (4)

(1) Subtract 37819 from 49765.
(2) Simplify $5{\cdot}894 \div 70$.
(3) Solve $3x-5=7x-21$.
(4) Simplify $\frac{2}{3}+\frac{1}{5}\div(\frac{2}{5}-\frac{1}{3})$.
(5) Find the prime factors of 5184.

### (5)

(1) Simplify $4{\cdot}4-0{\cdot}44$.
(2) Find the H.C.F. of 27, 72, 135.
(3) Find the area of a rectangle 7 metres long and $3\frac{1}{7}$ metres wide.
(4) Find the volume of a box the internal measurements being 15 cm by 11 cm by 8 cm.
(5) How many tennis balls at Rs. 3·25 each can be bought for Rs. 91?

### (6)

(1) Find the value of $156560 \div 152$.
(2) $0{\cdot}075 \times 120 =$ ?
(3) If $x=2$, $y=3$, $z=4$, find the value of $2x^2+3y^2+4zx$.
(4) Find the perimeter of a rectangular cardbord 17 cm long and 10·5 cm wide.
(5) Solve $\frac{3x}{5}+7=\frac{4x}{5}+5$.

### (7)

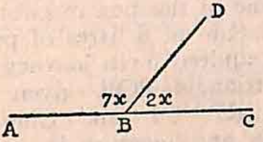
(1) Simplify $4\frac{1}{4}-3\frac{7}{8}+1\frac{11}{16}$.
(2) Express as fraction (a) 3·725 (b) 0·008.
(3) Find the L.C.M. of 4, 12, 15, 6, 20.
(4) A train was running 80 minutes late. It arrived at a station at 8.14 a.m. At what time would it have arrived had it been running 3 minutes early ?
(5) A dealer buys gramophones at Rs. 112 each and sells them at Rs. 180 each. What profit does he make on 27 gramophones ?

### (8)

(1) (*a*) Multiply 379 by 63, using factors.
(*b*) Divide 8855 by 35 using factors.
(2) Express $\frac{1}{2}$, $\frac{1}{8}$, $\frac{5}{8}$ as decimals.
(3) Find the cost of 49 articles at Rs. 3·12 each.
(4) How many grams are there in 2 Kg 5 Hg 4 gm ?
(5) Express (*a*) 3524 m; (*b*) 255 m, (*c*) 25 m in Kilometers.

### (9)

(1) Simplify $12\frac{1}{2}+8\frac{3}{4}-8\frac{7}{8}+13\frac{5}{8}$.
(2) If 32 cows are equal in value to 80 sheep, how many sheep are worth 48 cows ?
(3) Express in grams (*a*) 15 gm 5 cg (*n*) 23 mg (*c*) 4 Dg 5 cg.
(4) ABC is a straight line. Find the value of x.



(5) Construct the triangle ABC, given that angle B=49° angle C=65° and BC=7·1 cm.

### (10)

(1) A boy's temperature at 9 a.m. is 99·6 degrees and 101·2 at 12 noon. Find the increase in temperature.
(2) A rectangular field is 48400 sq metres. If it is 440 metres long, find the perimeter of the field.
(3) A picture 20 cm by 12 cm is mounted on a card board so that there is a margin 2 cm wide all round the picture. What area of the card board is left uncovered ?
(4) Solve 5−x=2·8.
(5) Rs. 16 is shared between two boys A and B so that A gets Rs. 1·50 more than B. How much does A receive?

## (11)

(1) Simplify $(\frac{1}{2}+\frac{1}{3})-(\frac{1}{2}-\frac{1}{3})$.
(2) Express in prime factors $12\times16\times21\times28$.
(3) (*a*) Express 80 metres in Km.
(*b*) Express 0·0125 as a fraction.
(4) Make a bill for the following :
5 Kg sweets at Rs. 6·36 a Kg.
$2\frac{1}{4}$ metres of material at Rs. 3·48 a metre.
2 dozen eggs at Rs. 2·84 a dozen.
(5) In a test a boy gets 12 out of a maximum of 30. What is his percentage ?

## (12)

(1) Simplify $\frac{2}{3}\times\frac{20}{27}\div\frac{4}{9}$.
(2) A boy obtained 33 out of 60 in a History test. Find his percentage.
(3) A box is 1 metre long 75 cm wide and 22 cm high. Find the volume of the box in cubic centimetres.
(4) A car does 42 Km on 6 litres of petrol. How many litres will be required for a journey of 329 Km ?
(5) Construct a triangle PQR given that PQ=9 cm, QR=7·2 cm, RP=8·1 cm. Construct the incircle of the triangle and measure its radius.

## (13)

(1) (*a*) Add 3·79; 11·04; 5·12; 6·001.
(*b*) Subtract 3·2 from 5·009.

(2) Solve (i) $11x+5=41-7x$ and (ii) $\frac{3}{x}=\frac{2}{5}$

(3) I buy an article for Rs. 32 and sell it for Rs. 36; find the profit per cent I obtain.
(4) A boy in an examination obtains 84 in History, 80 in English, 73 in Science, 71 in Art, 56 in Hindi and 50 in Mathematics. Find his average marks.
(5) A man cycles from a town 10 Km due east and then 15 Km due south. Find by scale drawing how far he is from his starting point.

## (14)

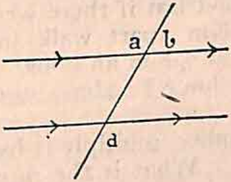
(1) Multiply 7·62 by 60. Without further multiplication write down the answers for the following (a) $7{\cdot}62 \times 600$ (*b*) $7{\cdot}62 \times 6$.

(2) A glass flask when empty weights 82 gm; 150 cc. of water is poured into it. Find the weight of the flask and water.

(3) 24 men dig a trench in 14 days. How long will 42 men take to do the same piece of work ?

(4) The vertical angle of an isosceles triangle is 84°. Find the base angles.

(5) If angle 'a'=110° find the angle 'b' and 'd', giving reasons for your answers.



## (15)

(1) If $\frac{8}{5} = \frac{p}{100}$ find the value of p.

(2) Express 8 cm as the fraction of 1 metre, the decimal of 1 metre, and the percentage of 1 metre.

(3) A toy costing Rs. $4\frac{1}{2}$ was sold for Rs. 6. Find the gain per cent.

(4) A train travelling at 72 Km an hour completes a journey in 8 hours. How long would it have taken if its speed had been 64 Km an hour ?

(5) The angles of a triangle are 3x°, 5x° and 7x°. Find the value of x and the angles of the triangle.

## (16)

(1) Simplify (*a*) $\frac{1}{2}$ of $\frac{1}{4}+\frac{3}{8}$ (*b*) $\frac{2}{3}-\frac{1}{6}$ of $\frac{9}{10}$.
(2) Reduce to lowest terms (*a*) $\frac{120}{124}$ (*b*) $\frac{77}{154}$ (*c*) $\frac{143}{165}$.
(3) A lawn 12 metres long and 9 metres wide is surrounded by a gravel path $1\frac{1}{2}$ metres wide. Find the area of the gravel path.
(4) A sum of Rs. 864 is to be shared between three people in the ratio 2:3:4. Find the share of each person.
(5) A motorist leaves a place O and travels 40 Km due north and then 9 Km due east. Find by drawing how far he is from his starting point. (Use your own scale).

## (17)

(1) Write down all the prime numbers between 80 and 110.
(2) Twenty four men have rations for 15 days. How long will the food last if there were six men less ?
(3) Two men 12 Km apart walk towards one another each travelling at 4 Km an hour. How far apart are they after one hour ? How much longer will they take to meet ?
(4) I think of a number, multiply it by 3 then add 17 and the result is 44. What is the number ?
(5) A man does S metres in T hours. What is his speed in metres per hour ?

## (18)

(1) Find the cost of 1000 Doric fountain pens at five for Rs. 45.
(2) Write the following statement as an equation :
The area of a triangle is half the product of its base (b) and height (h).
If $b=12$ cm and height 7 cm, find its area.
(3) A cube has a side of $2\frac{1}{2}$ cm. Find its volume.
(4) In a school there are 456 children. $\frac{3}{8}$ of them are girls, find the number of boys in the school.
(5) I fill a jug with water using a mug having a volume of 125 cc. If the jug holds $5\frac{1}{2}$ litres, how many mugfuls are needed to fill the jug ?

## (19)

(1) John has $\frac{3}{5}$ as much money as Tom. If $\frac{2}{3}$ of Tom's money is Rs. 12, how much has John ?

(2) The average weight of a crew of 8 men is 55 Kg. If the boat weighs 95 Kg, find the total weight of the boat and crew.

(3) Find the area of the four walls of a room, 8 metres long, 6 metres wide and 3 metres high.

(4) 8 years ago a man was $(x-3)$ years. Find his age 8 years hence. If $x=37$, find his age 12 years hence.

(5) Solve $\frac{7x}{5}+2=\frac{2x}{5}+10.$

## (20)

(1) Find the area of card-board required to make an open box the external measurements of which are 15 cm by 12 cm by 11 cm.

(2) Solve $8x-11=185-6x$.

(3) Write an equation for the following statement: "Eight times a number exceeds 5 times the number by 36". Solve this equation to find the number.

(4) A room 9 metres long, 7 metres wide and $3\frac{1}{2}$ metres high has its walls papered. Find the area of paper required, if $15\frac{1}{2}$ sq. metre is taken up by windows and doors.

(5) In the school infirmary the following temperatures of a boy were recorded at different times of the day.

| Time | 6 a.m. | 9 a.m. | 12 noon | 3 p.m. | 6 p.m. |
|---|---|---|---|---|---|
| Temp. | 99·1 | 100·4 | 101·6 | 102·4 | 101·6 |

Scale 2 cm = 1 degree
2 cm = 3 hours.

Draw the graph and write down the temperature of the boy at 10.30 a.m. and 7.30 p.m. How much did the boy's temperature rise between 9 a.m. and 9 p.m. ?

## (21)

(1) Express the following fractions in their lowest terms :
$\frac{63}{108}$; $\frac{94}{124}$; $\frac{68}{153}$.

(2) Simplify (*a*) $\frac{1}{5}+1\frac{1}{6}+1\frac{1}{7}$ and (*b*) $(\frac{5}{8}\times\frac{4}{7})-\frac{1}{3}$.

(3) Find the value of (*a*) $15{\cdot}4\times12$ (*b*) $6{\cdot}27\div6$.

(4) Express as percentages (*a*) $\frac{3}{4}$ (*b*) $\frac{7}{8}$ (*c*) $\frac{1}{40}$.
In a bag of coins 2% was silver, 28% was nickel and the rest copper. What fraction of the whole was copper.

(5) A brass tablet on the school was 27 cm by 14 cm. The board to which it is fixed is 32 cm by 19 cm. Find the area of the border.

(6) A lady bought 12 metres of nylon for Rs. 150. She used $3\frac{1}{2}$ metres of it to make a dress. What was the cost of the nylon in the dress ?

(7) $\frac{5}{6}$ of a certain sum of money is Rs. 2250, what is $\frac{2}{3}$ of it ?

## (22)

(1) Simplify $4\frac{1}{8}-(1\frac{1}{3}+2\frac{1}{2})$.

(2) Find the L.C.M. of 32, 40, 48.
Find the H C.F. of 45, 75, 105.

(3) Construct a triangle ABC, given that $AB=7{\cdot}5$ cm, $BC=8{\cdot}2$ cm and angle $ABC=71°$. Construct the circle inside the triangle to touch all three sides. Measure its radius.

(4) If $a=12$, $b=7$, $c=5$, find the value of $ab+bc-ca$; $a^2+bc-ac$; $3a-2b+4c$.

(5) If Rs. 279 is divided between two people in the ratio of 5:4, find the share of each.

(6) A man sold $\frac{3}{4}$ of his crop of wheat and had 264 Kg. left. What weight would have remained if he had sold $\frac{5}{6}$ of his crop ?

(7) ABC is an isosceles triangle having $AB=AC$. If $AB=(2x+7)$ cm and $AC=(28-3x)$ cm, find the value of x and the length of each side.

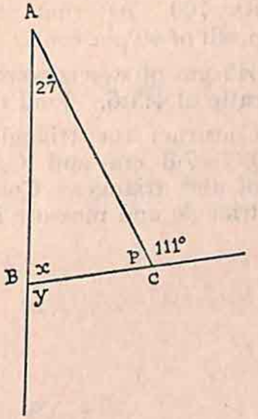
## (23)

(1) Draw a circle of radius 4 cm and divide it into 5 equal parts.

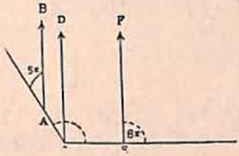
(2) Draw a circle of radius 5 cm and inscribe a regular hexagon. Find the perimeter of the hexagon.

(3) Draw a triangle ABC such that BC=8 cm, angle B=48° and angle C=54°. Draw the perpendicular from A to BC and measure it.

(4) Find the values of angles x, y and p.



(5)



AB, CD, EF are parallel straight lines.
angle ACE=130°.
Find the value of x and the angle ABC.

(6) The perimeter of a rectangle (3x−4) cm by (2x+1) cm is 48 cm. Find the value of x and use this value to find (*a*) the length of the rectangle, (*b*) the breadth of the rectangle, (*c*) the area of the rectangle.

(7) A man buys an article for Rs. 72 and sells it at a profit of 15%. Find the selling price.

## (24)

(1) Express as regular fractions in their lowest terms : (*a*) ·85 (*b*) 0·225 (*c*) 0·0375.

(2) Find the value of (*a*) $1{\cdot}09 \times 23$ (*b*) $2{\cdot}87 \div 35$ (*c*) $28 + 96 \times 3 - 14 \div 7$.

(3) A train travelling at 80 Km an hour does a journey in 12 hours. How long will it take to do the same journey at 72 Km an hour ?

(4) A boy in an examination obtains 80% out of a total of 765 marks. How many marks did he get ?

(5) A merchant bought drawing-room furniture-set for Rs. 700. At what price must he sell it to make a profit of 40 per cent ?

(6) 645 gm of sweets were divided between 3 boys in the ratio of 4:5:6. Find the share of each boy.

(7) Construct the triangle ABC given that AB=7 cm, BC=7·8 cm and CA=9 cm. Measure the angles of the triangle. Construct the circumcircle of the triangle and measure its radius.

## REVISION EXAMPLES

1.

(1) 327; (2) 211498; (3) Rs 176·15; (4) $3 \times 7 \times 11$; (4) 517·02.

2.

(1) 5253; (2) 12493; (3) 278; (4) Rs. 9·47; (5) 19·8.

3.

(1) 6·05; (2) 1090; (3) 2·439; (4) $\frac{1}{2}$; (5) 3025 gm; 3·025 Kg.

4.

(1) Rs. 80; Rs. 92; Rs. 100; (2) 1·569 Kg.
(3) 176·35; 352·7; 3527; (4) $2 \times 3^5 \times 7$; (5) 12.

5.

(1) $2^9 \times 3 \times 5$; $2^5 \times 3^4$. (2) 17. (3) 180. (4) Rs. 1·80; 140 cm; 35 min. (5) 9/4; 5/6.

6.

(1) $2^4 \times 3^2 \times 11$; $2 \times 5 \times 11 \times 13$. (2) H.C.F. 3; L.C.M. 3600
(3) 8 (4) Rs. 49.

7.

(1) L.C.M. 216; H.C.F. 6; (2) Rs. 4·68; (3) 2; 50/99;
(4) 0·32; 2·3; 0·0312; (5) 12·5m.

8.

(1) 10·13; (2) 2·22; 2·19; (3) 3/5; 6/25; 3/4; 1/8;
(4) 0·6; 0·625; 1·8; 4·375; (5) 21·6; 0·75; 0·44.

9.

(1) 7·91; (2) 1/4; (3) 11/12; (4) 1232m; 6160m.
(5) Rs. 98.

10.

(1) 48; (2) 12 days; (3) 277/90; 12/21. (4) 25·90 Rs.
(5) 51.

11.

(1) 4·251 Kg; 0·789 Kg.; 0·078 Kg. (2) 90 sq. m.; 39m. (3) 88 sq. m. (4) 4150 cc. (5) Rs. 270.

12.

(1) 20 litres; (2) 95 sq. cm; (3) Rs. 20; (4) 48 Kg. (5) 203·2 kg.

## REVISION TESTS

1.

(1) 2662·8; (2) $3^4 \times 7$; (3) $3\frac{7}{8}$; (4) 34·164; (5) 49.

2.

(1) 253.77; (2) $3^3 \times 2^5 \times 7$; (3) 0·16; (4) 93°; (5) $p=0{\cdot}6$.

3.

(1) $3^2 \times 5^2 \times 7^2$; (2) $4\frac{3}{4}$; (3) 13·33; (4) $1\frac{2}{7}$; (5) 50; 100; 200.

4.

(1) 11946; (2) 0·0842; (3) $x=4$; (4) $3\frac{2}{3}$ (5) $3^4 \times 2^6$.

5.

(1) 3·96; (2) 9; (3) 22 sq metres (4) 1320 cu. cm; (5) 27.

6.

(1) 1030; (2) 9; (3) 67; (4) 55 cm; (5) $x=10$.

7.

(1) $2\frac{1}{16}$; (2) $3\frac{23}{40}$; $\frac{1}{125}$; (3) 60; (4) 6·51 a.m. (5) Rs. 1836.

8.

(1) 23877; 253 (2) 0·5; 0·125; 0·625. (3) Rs. 152·88. (4) 2504 gm (5) 3·524 Km; 0·255 Km; 0·025 Km.

### 9.

(1) $26\frac{5}{24}$; (2) 120; (3) 15·05 gm.; 0·023 gm.; 0·45 gm.

### 10.

(1) 1·6°; (2) 1100 m; (3) 174 sq. cm; (4) $x=2{\cdot}2$;
(5) Rs. 8·75.

### 11.

(1) 2/3; (2) $2^8 \times 3^2 \times 7^2$; (3) 0·08 m; $\frac{1}{80}$ (4) Rs. 46·73;
(5) 40%.

### 12.

(1) $1\frac{1}{9}$; (2) 55%; (3) 165000 cu. cm.; (4) litres.

### 13.

(1) 25·981; 1·809; (2) $x=2$; $x=7\frac{1}{2}$; (3) $12\frac{1}{2}$% (4) 69;
(5) 18·03 km.

### 14.

(1) 457·2; 4572; 45·72; (2) 232 gm; (3) $24\frac{1}{2}$ days.
(4) 48°. (5) $\angle b=70°$, $\angle d=110°$.

### 15.

(1) $p=160$; (2) $\frac{2}{25}$; 0·8% (3) $33\frac{1}{3}$%; (4) 9 hrs;
(5) $x=12$; 36°; 60°; 84°.

### 16.

(1) $\frac{1}{2}$; $\frac{17}{80}$; (2) $\frac{80}{81}$; $\frac{1}{2}$; $\frac{13}{15}$. (3) 72 sq. m. (4) 192; 288; 38.
(5) 41 km.

### 17.

(1) 83, 89, 97; 101, 103, 107, 109.
(2) 20 days; (3) 4 km; $\frac{1}{2}$ hr.; (4) $x=9$; (5) $\frac{S}{T}$.

### 18.

(1) Rs. 9000; (2) $\frac{1}{2}bh=A$; 42 sq. cm; (3) $15\frac{5}{8}$ cu. cm.
(4) 285; (5) 44 mugs.

### 19.

(1) Rs. 10·80; (2) 535 kg.; (3) 84 sq. m; (4) $x+13$; 54 yrs.
(5) $x=8$.

### 20

(1) 774 sq. cm; (2) 14; (3) $8x-5x=36$; $x=12$; (4) $97\frac{1}{2}$ sq m.

### 21.

(1) $\frac{7}{12}$; $\frac{3}{4}$; $\frac{4}{9}$; (2) $3\frac{107}{210}$; $\frac{1}{42}$; (3) 184·8; 1·045; (4) 75%; $87\frac{1}{2}$% $2\frac{1}{2}$%; $\frac{3}{10}$; (5) 160 sq. cm. (6) Rs. 43·75; (7) Rs. 1·800.

### 22.

(1) $\frac{7}{24}$; (2) L.C.M. 480; H.C.F. 5. (4) 59; 119; 424; (5) Rs. 155; Rs. 125; (6) 176 kg.; (7) 4·2; 15·4 cm.

### 23

(6) $x=$ 5·4 cm. (7) Rs. Rs. 82·80.

Length =12·2 ,,
Breadth =11·8 ,,
Area =143·96 sq. cm.

### 24

(1) $\frac{17}{20}$; $\frac{9}{40}$; $\frac{3}{80}$; (2) 25·07; 0·82; 314; (3) 13 hrs. 20 min.; (4) 692; (5) Rs. 980; (6) 172; 215; 258.

### Indian

100 naya paise (nP.) = 1 rupee (Re)

### American

100 cents = 1 dollar ($)

### French

100 centimes = 1 franc (fr)

## TIME

60 seconds = 1 minute
60 minutes = 1 hour (hr)
24 hours = 1 day
7 days = 1 week
365 days = 1 year
366 days = 1 leap year
12 months = 1 year

"Thirty days hath September,
April, June, and November.
All the rest have thirty-one
Excepting February alone,
Which has but twenty-eight days clear,
And twenty-nine in each leap year."

You are given below a diagram of the Mariner's Compass. The Mariner's Compass is used for finding directions. In the diagram the needle or pointer is not shown. The pointer swings on a pivot at the centre of the compass. It is made of magnetised steel or iron, and, if it is allowed to swing freely, it will come to rest pointing due *north*. The mariner, or the traveller, or whoever is using the compass, then turns the compass dial round till the north line

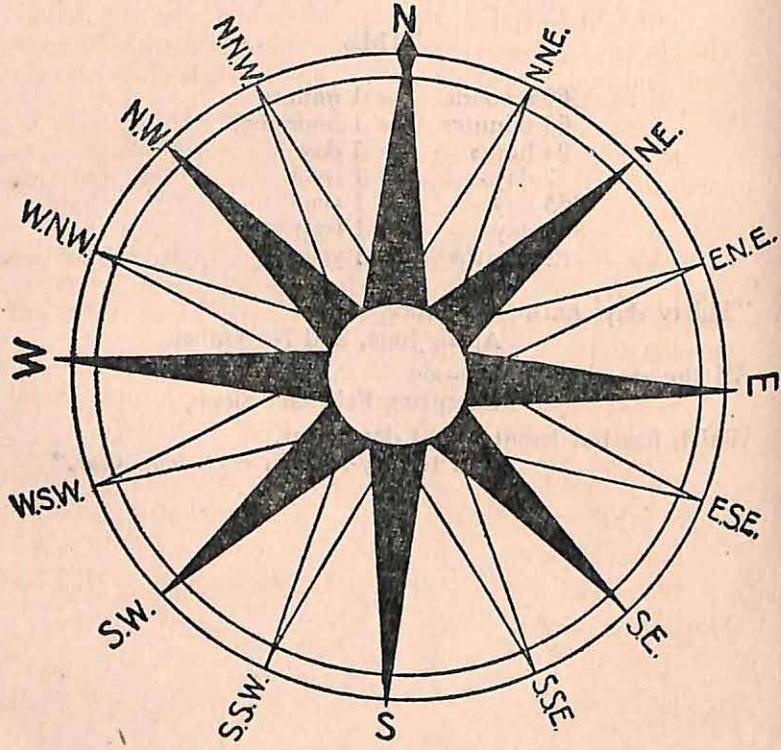


Fig. 20

of the dial comes directly under the pointer. The dial then shows all the other directions at the same time.

On a sheet of stiff paper draw a circle of 3 in. radius and cut it out.

Fold the circle in halves. The crease gives us a diameter. Mark the ends of this diameter North (N) and South (S). The diameter itself we shall call the north-south line.

Fold the north-south line on itself. The crease gives us another diameter at right angles to the north-south line. This is the east-west line. Hold the circle with N away from you and S towards you. Then mark E (East) on the right of the east-west line and W (West) on the left.

N, S, E, W are called the cardinal (or chief) points. The north-south and the east-west lines divide the dial into quarters.

Fold the circle so as to divide each quarter into two equal parts. The creases give the following directions north-east, south-east, north-west, south-west. Mark them off on your dial.

Fold again so as to divide each eighth up into two equal parts. The creases give us the following directions :

North-north-east (N.N.E.); South-south-west (S.S.W.)
North-north-west (N.N.W.); South-south-east (S.S.E.)
East-north-east (E.N.E.); West-south-west (W.S.W.)
West-north-west (W.N.W.); East-south-east (E.S.E.)

Mark these on your dial.